Pontenossa S.p.A. Industrial Site

Ponte Nossa (Bergamo)

White Paper

HEALTH, SAFETY AND ENVIRONMENT

A REPORT ON

ECO-COMPATIBILITY/SUSTAINABILITY

Prof. Luigi Manzo
University of Pavia

May 2013

INDEX

9. SOCIAL SUSTAINABILITY
9.1. Introductory concepts: modern indicators for sustainable development.
9.2. Company policy and initiatives
    9.2.1. Conformity with standards
    9.2.2. Ethic Code
    9.2.3. Legislative Decree 231/2001 and risk of environmental offences
    9.2.4. Importance of economic and social initiatives

10. CRITICISM
10.1. Criticism of regulations
10.2. Remarks raised by local movements and associations

11. RECOMMENDATIONS, AREAS OF IMPROVEMENT
11.1. Company policy concerning the environment and sustainable development
11.2. Technological, organizational and managerial aspects
11.3. Territory, landscape, water resources
11.4. Monitoring of air quality
11.5. Noise pollution
11.6. Material containing asbestos
11.7. Health checks on workers
11.8. Management of emergencies
11.9. Economic and social aspects, relations with the local community
11.10. Code of voluntary conduct

12. DOCUMENTATION SOURCES

APPENDIX
Check list of legislative conformity

1. INTRODUCTION

This Document was created in view of a scientific agreement between Pontenossa S.p.A. and Pavia University in order to examine the activities carried out by the company located in Ponte Nossa (Bergamo) and to evaluate its impact on the environment, health, safety, social sustainability and territorial compatibility.

This study is part of a program recently initiated by the company to inform citizens and other parties involved regarding correlations between production processes, seen as potentially harmful to the environment, and the actual state of the environment in the Seriana Valley area where the company's production site is situated.

This task originated from an examination of technical material listed in the Section "Documentation Sources", evaluated using criteria already illustrated in previous studies (Ref. 1, 2). The method of analysis uses the actual principles of "Environmental Medicine Based on Scientific Evidence" (Ref. 3) and recognizes the indicators that National and International agencies have introduced in the last few years to assess impact to the state of the territory. (Ref. 4).

The White Paper examines an industrial reality that is in possession of required legal authorization. Its objective is not to act as a substitute for public organisms nor intends to offer a static description of the reality of Pontenossa with the sole aim of confirming its legal conformity and standards. It aims instead to evaluate the global sustainability of its site in relation to the level of effectiveness of managerial procedures and adopted policies thus identifying areas of improvement through technical checks that could have positive results for health, safety and the environment.

2. THE PRODUCTION SITE

The report entitled “Productive History of Pontenossa’s Production Site” (Ref. 5) summarizes the history of the plant and lists in cronological order the structural interventions that have led to the use of the technologies implemented today. Productive activity began because of the presence of zinc and lead mines exploited by the Celts right up to the arrival of the Romans.
Processing activity in the field of non iron metal production continued even after the mines were closed at the beginning of the 80s resulting in the possession of plant assets and advanced technological knowledge of the sector.

2.1. Historical Context (Ref. n. 5)

The plant opened in May 1952 with the production of electro-lithic zinc (35.000 t/a) and sulfuric acid (40.000 t/a). In order to increase the production of zinc, a fluid surface furnace was installed in 1968/1969 for the treatment of blends and replaced the tiered type furnace. At the same time the electrical power station, electrolysis lab and foundry section were refurbished and automatic ingot casting plants were installed, a type of alloy production adding a new catalyst to the sulphuric acid plant.

In 1971, in order to diversify the manufacturing process, another department was built called “Polvox” for the production of zinc oxide and zinc dust using both electrolithic zinc and zinc “mattes” from zinc galvanizing (about 4000 tons/year) as raw materials. In 1982 treatment of zinc minerals is discontinued and hence also the production of sulphuric acid. A ginning machine is set up to grind slags obtained from the fusion of zinc and brass.

In 1985, ENI group installed and set up a plant for the treatment of steel work fumes and the production of Waelz oxide by reconverting the structure of the old plant that treated minerals that came from the zinc mines of the area which had now become depleted. The production of electro-lithic zinc was suspended the following year due to the high cost of production and raw materials. In 1992 the production of zinc and copper salts was stopped and only the zinc oxide plant and Waelz furnace continued working.

In 1994 the plant was sold to private shareholders and Pontenossa S.p.A. was created**,** taking over the management of the company. The production of distilled and blown zinc powder was discontinued. Since then the company has specialized in the recycling of metals present in residual dust from steel production in iron-working plants.
Today the company operates closely with most of the steel works in the North of Italy guaranteeing a continuous activity of collection and recycling. The powder is then resold in the form of Waelz oxide. Over the twenty five years of uninterrupted activity, the recycling process has been increasing gradually reaching 70.000 tons of powder treated annually to 155.000 tons today (Ref. 5) which correspond to about 70% of steel work fumes produced in Italy.

Since it was first built to the present day, the production plant has changed hands several times as shown in table no. 1.

Table n. 1. Production Site Pontenossa S.p.A. Passage of ownership in Cronological Order.

- from 1952	S.A.P.E.Z. S.p.A.
- from 1955	AMMI S.p.A.
- from 31-12-1978	SAMIM S.p.A.
- from 01-01-1984	SAMETON S.p.A.
- from 01-06-1987	NUOVA SAMIM S.p.A.
- from 11-10-1993	ENIRISORSE S.p.A.
- from 12-07-1994	PONTENOSSA S.p.A.

With the evolution of the various processes, many changes have taken place including treated materials and products (Table n. 2).

Table n. 2. Historical outline of changes relating to treated materials and products in Pontenossa

From 1952 to 1971		
Treated materials	**Manufactured and semi-manufactured products**	**Reagents**
Blends (ZnS) Calamine (ZnC03) Smithsonite (Zn(OH)2.Si03)	Electrolithic Zinc Sulphuric Acid Blown Zinc Powder Distilled Zinc Powder Zinc Alloys Cadmium	Sulphuric acid Potassium permanganate Zinc powder Iron sulphate Copper sulphate Beta naphthol Ethanegliossime Active carbon Hydrogen peroxide Lime Flocculants (Separan,Daradrain) Pyrolusite Strontium sulphate (celestine) Glue (distributed over the surface of the electrolysis cells) Ammonium cloride (for the scoring of smelting furnaces) Azamine (for degassing water in boilers) Hydrochloric acid (demineralization of water for boilers) Caustic soda (demineralization of water for boilers) Nalco (Softening of water for refridgerators)
From 1971 to 1982		
Treated materials	**Manufactured and semi-manufactured products**	**Reagents**
As above adding: Surface Mattes Base Mattes	As above adding: Various sealing of Zinc Oxide	As above adding: Propionic Acid
From 1982 to 1985		
Treated materials	**Manufactured and semi-**	**Reagents**

	manufactured products	
Surface Mattes	Second casting brass slags	Sulphuric acid
Base Mattes	Zinc suphate	Potassium permanganate
Zinc casting slags	Zinc carbonate	Zinc powder
Brass casting slags	Copper sulphate	Ferrous sulphate
Muller mud	Cu in cathodes	Copper sulphate
Zinc cinders	Blown zinc powder	Beta naphthol
	Distilled zinc powder	Ethanegliossime
	Various sealing of zinc oxide	Active carbon
		Hydrogen peroxide
		Hydrated lime
		Flocculants (Separan, Daradrain)
		Pyrolusite
		Strontium sulphate (celestine)
		Glue(distributed over the surface of the electrolysis cells)
		Ammonium cloride (for the scoring of smelting furnaces)
		Azamine (for degassing water in boilers)
		Hydrochloric acid (demineralization of water for boilers)
		Caustic soda (demineralization of water for boilers)
		Nalco (Softening of water for refridgerators)
		Proprionic acid

From 1985 to 1986

Treated materials	**Manufactured and semi-manufactured products**	**Reagents**
Surface Mattes	Electrolithic zinc	Sulphuric acid
Base Mattes		
Zinc casting slags		
Brass casting slags		
Muller mud		
Zinc cinders		
Steel work fumes	Zinc alloys	Potassium permanganate
	Zinc sulphate	Zinc powder
	Carbonate of Zinc	Ferrous sulphate
	Copper sulphate	Copper sulphate
	Cu in cathods	Beta naphthol
	Ethene gliossime	
Blown zinc powder		
	Distilled zinc powder	Active carbon
	Various sealing of zinc oxide	Hydrogen peroxide
	Waelz oxides	Dehydrated lime
		Flocculants (Separan, Daradrain)
		Pyrolusite
		Strontium sulphate (celestine)
		Glue (distributed over the surface of the electrolysis cells)
		Ammonium chloride (for the scoring of smelting furnaces)
		Azamine (for degassing water in boilers)
		Hydrochloric acid (demineralization of water for boilers)
		Caustic soda (demineralization of water

		for boilers) Nalco (Softening of water for refridgerators) Anthracite Coke Lime scale Propionic acid

from 1986 to 1992

Treated materials	Manufactured and semi-manufactured products	Reagents
Surface mattes Base mattes Zinc casting slags Zinc cinders Steel work fumes Brass casting slags Muller mud	Zinc alloys Zinc sulphate Carbonate of Zinc Copper sulphate Blown zinc powder Distilled zinc powder Various sealing of zinc oxide Waelz oxides	Sulphuric acid Potassium permanganate Zinc powder Ferrous sulphate Copper sulphate Beta naphthol Ethane gliossime Active carbon Hydrogen peroxide Dehydrated lime Flocculants (Separan, Daradrain) Ammonium chloride (for the scoring of smelting furnaces) Azamine (for degassing water in boilers) Hydrochloric acid (demineralization of water for boilers) Caustic soda (demineralization of water for boilers) Nalco (Softening of water for refridgerators) Anthracite Coke Live lime Propionic acid

From 1992 to1994

Treated materials	Manufactured and semi-manufactured products	Reagents
Surface mattes Base mattes Zinc casting slags Zinc cinders Steel work fumes	Blown zinc powder Distilled zinc powder Various sealing of zinc oxide Waelz oxides	Sulphuric acid Ferrous sulphate Hydrogen peroxide Dehydrated lime Flocculants (Separan, Daradrain) Hydrochloric acid Anthracite Coke Live lime Propionic acid

From1994 to 2002

Treated materials	Manufactured and semi-manufactured products	Reagents
Surface mattes Base mattes Zinc cinders Steel work fumes	Various sealing of zinc oxide Waelz oxides	Sulphuric acid Ferrous sulphate Hydrogen peroxide Dehydrated lime Flocculants Hydrochloric acid Anthracite

	From 2002 to 2012	
Treated materials	**Manufactured and semi-manufactured products**	**Reagents**
		Coke Live lime Propionic acid
Steel work fumes	Waelz oxides	Sulphuric acid Dehydrated lime Flocculants Hydrochloric acid Anthracite Coke Live lime

2.2. Production activity

This activity involves the recycling of zinc powder ("steel work fumes") obtained mainly from the casting of iron scraps in metallurgic plants using technology known as Waelz process I. Steel work fumes are classified as special waste and normally end up being disposed of in dumps. The Waelz process (Ref. 6, Ref. 29) therefore offers an alternative to the dumping of this material (Figure n. 1).

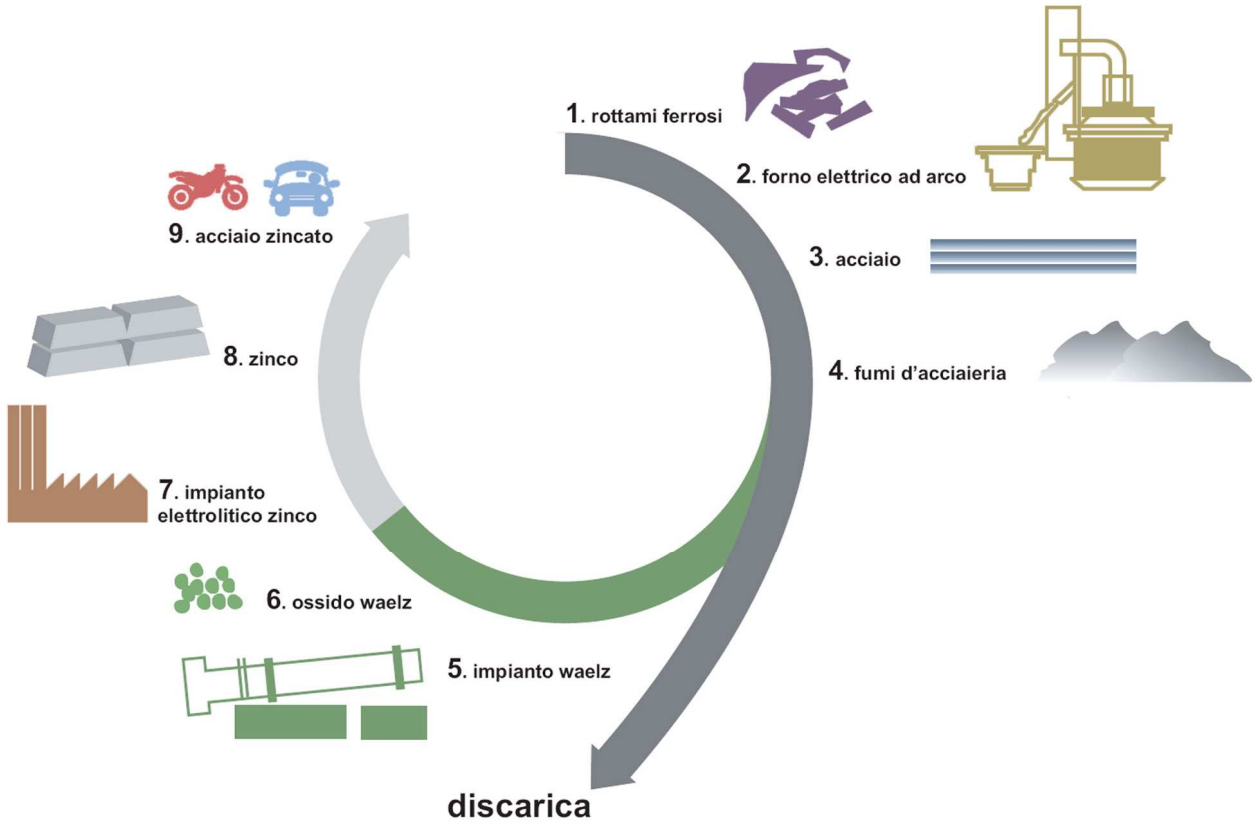


Figure n. 1. Position of Waelz Process during the zinc cycle.

Originally used to enrich zinc minerals, the Waelz process was optimized in the seventies in order to treat dust from steel works in Germany and Italy and then went on to include also other European countries and countries overseas such as Japan and the United States. This is

carried out in furnaces that use a rotary action at a high temperature using coal as a reducing agent.

Through treatment of the powders, the zinc and lead in them can be extracted and the above mentioned metals can be recycled in oxide form (Waelz oxide). For this process the Pontenossa plant has been using technology based on the re-oxidation of iron since 2001 and this has brought two advantages (i) it limits the amount of coal used and (ii) it reduces the amount of weight of slags produced per unit of incoming fumes. From Waelz oxide and other manufacturing processes, zinc metal is obtained (Ref. 29). The total retrieval of metals is equal to 88-94% for zinc and 70-80% for lead.

Recycling activity runs on a continuous cycle of three shifts for 7 days a week.

Table n. 3. Production of Waelz oxide in Pontenossa.

YEAR	PRODUCTION (in tons)
2008	51.048
2009	50.531
2010	46.891
2011	48.222
2012	47.662

The production of Waelz (Table n. 3) oxide enables elements to be extracted from industrial waste and reused in the global productive cycle where it can be applied in various technological sectors (e.g. zinc metal production) and at the same time reduce impact on the environment connected to the dumping of steel work fumes. As we have already mentioned, the alternative to the Waelz process would be the transfer of these powders to a dump where they would remain in a preliminary state of inactivity, necessary in order to avoid any dispersal of heavy metal, and which would lead to an average increase in volume of 30-40%.

Various Waelz plants similar to those used by Pontenossa S.p.A. are now operative in Europe (Table n. 4).

Table n. 4. Waelz plants in Europe

Italy

- The **PORTOVESME s.r.l.** plant situated in Portoscuso (CI, 5.000 inhabitants) in the industrial 5 km from the town centre

Germany

- **BEFESA** plant situated in Duisburg (490.000 inhabitants) 7 km from city centre
- **BEFESA** plant situated in Freiberg (43.000) 3 km from city centre

France

- **RECYTECH** plant (50% owned by Befesa) situated in Fouquières-lez-Lens (6.500 inhabitants) 2 km from town centre and 30 km from Lille (233.000 inhabitants)

Spain

- **BEFESA** plant situated in Erandio (22.000 inhabitants) 2 km from town centre and 10 km from Bilbao (350.000 inhabitants)

Poland

- **BOLESŁAW RECYCLING** plant situated in Bukowno (10.000 inhabitants) 3 km from city centre

Bulgaria

- **KCM S.A.** plant situated in Plovdiv (350.000 inhabitants) 4 km from city centre

The project to increase productive capacity, authorized by Decree AIA n. 3403 of 4/4/2007, involves treatment of 180.000 tons per year of zinc related waste. The proposed set up in the project of enlargement doesn't involve any changes regarding the quantity of carbon used (about 90 tons per day) , amount of gas used up and amount of slags. The latter, however, take on new characteristics due to a stable compound of iron (ferrite calcium) and the reduced content of lead. Studies carried out by Pontenossa claim that in such a form the slags could find an alternative use to dumping and could be used, for example, as a support in the production of cement conglomerates and/or bitumen pastes (Ref. 16).

The activity of the plant is structured to treat other zinc related material with varying amounts of zinc and lead and can therefore be used for recycling and for the clearance of any temporary deposits and/or dumping of material containing non ferrous metals scattered over the National territory.

3. THE DISPOSAL SITE

The Waelz process produces inert slags which are transported, via an internal service road, to a single-waste dump, situated in the vicinity of the plant and owned by Pontenossa. The disposal site can be found in the Valle Rogno district of two neighbouring towns, Gorno and Premolo. It was first set up in 1962. Prior to Pontenossa it was owned by Enirisorse S.p.A., Nuova Samin S.p.A. and Sameton S.p.A. The first material to be deposited in it was residual mud from the electro-lithic manufacturing of zinc, following that, similar mud mixed with lime and without additional water, was stored there. On top of these materials Waelz slags, derived exclusively from the metal recycling process, were laid, initially, directly over the mud materials and later on top of impermeable sheets spread over a layer of clay (Ref 16).

In 1999, upon positive declaration of environmental compatibility on behalf of the Ministry of the Environment (Decree DEC/VIA/3055 of 16/6/1998), the Region of Lombardy (D.G.R. n. 43589 of 14/6/1999) authorized the enlargement of the site to hold a capacity of 500.000 m^3. Authorization was renewed by D.G.R. n. 17750/2004, with contextual application of the D.Lgs n. 36/2003 plan of adaptation. This authorized capacity had already been exhausted by December 2010. In the same month, following the Decree of Regional VIA n. 7023 of 08/07/2009 and relative Integrated Environmental Authorization n. 10115 of 07/10/2010 issued by the Region of Lombardy, the new volumetric system of approximately 683.500 m^3, was used and is currently being implemented.

The new arrangement enables continuous instrumental monitoring of the whole site as far as stability and hydro-geological aspect is concerned. The perchlorate product is collected using a catcher system and transported to a chemical cleaning plant, located at the nearby site.

The transfer of Waelz slags to the disposal site is carried out according to a complete project that foresees the final return to the area’s natural state and the revival of the Rogno Torrent riverbed with the final aim of restoring the valley’s characteristic geo-morphological aspect.

4. THE TERRITORY

The Pontenossa production site is located in the river valley area of the Upper Valle Seriana in the province of Bergamo. The plant is situated in the town of Ponte Nossa (BG) about 26 km from Bergamo, at 468 mt above sea level and lies between the Cima di Grem heights and the main provincial road n. 46 which from Ponte Nossa runs in the direction of Gorno. The plant is located in an area that the Ponte Nossa town council has reserved to Industrial activity through planning permission and its position is right on the left bank of the Riso torrent, a tributary of the river Serio, a few metres higher up compared to the stream bed itself and on the other side of the main provincial road n. 46 (fig. n. 2).

The disposal site where only Waelz waste is taken is in another area nearby spread between the towns of Gorno and Premolo. According to the planning permission of Premolo and Gorno councils, this area has been conferred as an industrial zone.

Fig. n. 2. Pontenossa S.p.A Plant., Ponte Nossa (Bergamo).

The Riso Valley holds the most important lead-zinc mines in Lombardy. Thanks to the mining industry, (an activity that goes back a thousand years in history and ended in the second half of the twentieth century) there are thousands of metres of underground tunnels and numerous open air disposal areas sited mainly half way up the left side of the valley.

The Riso torrent has its source in the southern heights of Cima di Grem at an altitude of 1350 metres above sea level and flows for 9.3 km before joining the river Serio on its right side at 445 mt above sea level and about one kilometre from the residential centre of Ponte Nossa. The hydro-graphic basin covers a total area of about 3 km^2 with an average gradient of 5.2%. The Riso torrent is characterized by a torrential type of flow of low amounts of water, unchanged in time. It has a strong current with high turbulence and is no deeper than 20-30 cm. The course of the torrent was originally modified in order to obtain part if the industrial area being discussed.

The landscape that is characteristic of this area is typical of the Bergamese Orobic Alps with sharp mountain features characterized by carved rocks produced by the many courses of water and the arrangement of hillsides alternately made up of ridges and fluvial incisions (Ref. 16).

The type of vegetation that can be found includes grass verges, grassy meadows, deciduous heliophilous shrubs, mesophilous broad-leaved woodland interspersed with conifers, evergreen trees and rock vegetation. The forestry heritage is made up of small areas of sparce and decayed broad-leaved plants mixed with a smaller quantity of conifers.

The presence of wildlife in the area includes roe deer, deer in Val Rogno, eagles nests on the mountains above and behind Premolo and colonies of swift, swallow and mountain swallow above and around the plant itself.

In a protected area at a distance of at least 2 km from the plant is the Sito di Interesse Interesse Comunitario (SIC) “Val Nossana Cima di Grem”, (Site of Community Interests) and is located behind the plant at an altitude of 1000-1500 mt above sea level covering a surface area of about 3.370 hectares. It extends from mount Arera (2512 mt) to the far north going south eastwards and ending at Val Nossana behind the town of Premolo. For SIC, the Incidence Test carried out by Pontenossa according to law DPR 120/2003 showed no significant impact.

As regards climatic features, the average annual temperature of the area in question is approximately 11°C. The hottest month is July (21°C) and the coldest is January which averages -0.19 °C. Abundant rainfall is distributed mainly over the periods of Spring, Summer and Autumn. Winds are measured within the Pontenossa plant and blow mainly in a north eastern direction (WNW e NW). -0.19 °C.

5. IMPACT FACTORS

5.1. General considerations

By “impact factors” we mean factors linked to previous and current activities of the plant and recognize its capacity to determine negative modifications to the environment and to human health such as dangerous materials and products handled in the plant, the production and management of contaminated waste, storage of fumes and raw materials, chemical emissions harmful to the atmosphere and to water ways. An accurate assessment of these factors is essential in order to establish the nature and size of potential risks linked to industrial pollution, particularly concerning exposal and ecological, health and social-economic impact (Fig. n. 3).

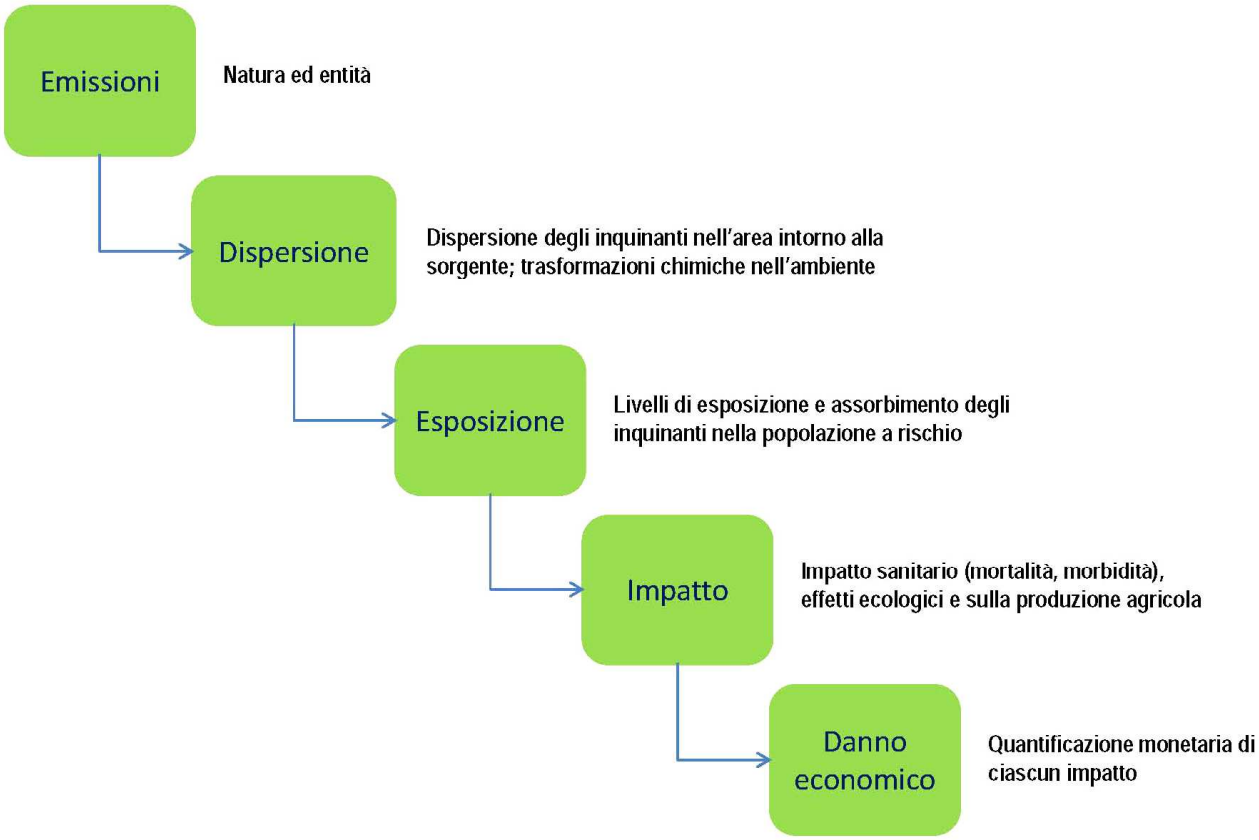


Fig. n. 3. Processes that determine the negative impacts of environmental pollution.

The assessment program is based on the analysis of ways in which the sources of impact are linked to environmental receptors of varying types, starting from the assumption that:

- Activities connected with the industrial process can give rise to events that act as disturbing factors to a pre-existing balance (impact causing factors); obviously the size of these factors don’t always produce negative effects on the environment in question.

- Impact factors produce modifications that are only visible in one part of the system’s elements, those which are identified as “sensitive receptors”.

- Impact on sensitive elements can determine multiple changes and can involve different matrices of the local territory (anthropic, ecological and landscape).

- Intensity , persistence e duration of exposure to single factors or to their various combinations are the parameters that enable us to define the quality and quantity of impact.

Analysis therefore requires an integrated approach: the properties of ecosystems consist of numerous factors and the ability to comprehend them is essential to assess the causes and effects of changes.

Factors of environmental pressure (e.g. certain production sites) produce changes that can differ from one situation to another depending on whether their impact is conditioned by specific local elements of a geographic, climatic, social or economic nature. In other words, changes have an impact on the state of an ecosystem in accordance with the properties of the ecosystem itself. Consequences are not only dependent on the level of environmental pressure (e.g. type of pollution) but also on the level of sensitivity and vulnerability of the local system and its capacity to absorb external pressure without being subject to an imbalance or to instability. Vulnerability increases when an ecosystem loses resilience, that is, it loses its capacity to absorb stress and conserve those functions that permit it to renew and rearrange itself (Ref. 7). In circumstances of instability, environmental pressures, even of modest nature, can produce significant effects.

These concepts take on significant relevance when changes and what causes them are evaluated in complex situations such as those concerning the relationship between pollution, state of the environment and public health.

5.2. Chemical products from the plant

Raw materials entering the Pontenossa plant come mainly from waste: steel work fumes and other types of zinc related waste of low zinc content to be processed in the Waelz furnace and waste known as “foundry fumes” with a high content of zinc which only needs washing (Table n. 5).

Table n. 5. Types of waste used as raw materials.

Common or general name	Risk classification	Main risk factors	Max quantities (t)
Steelwork fumes	N	Highly toxic for aquatic organisms; can provoke long term negative effects for the acquatic environment	20.000
Foundry fumes	N	Highly toxic for aquatic organisms; can provoke long term negative effects for the aquatic environment	200

Table n. 6 shows the typical composition of incoming steel work fumes in which the highest presence of zinc and iron can be found with low quantities of lead and various oxides.

Table n. 6 – Composition of incoming steel work fumes.

STEELWORK DUST FUMES	
Element	**Concentration %**
Zn	18-28
Pb	1,5-4
Fe	20-28
CaO	5-8
MgO	2-3
SiO_2	3-4

Maximum flow of steel work fumes and zinc waste needed to run the plant are currently 400-500 tons per day (Table n. 7). For its supplies, Pontenossa only takes into consideraton raw materials from nearby areas in order to guarantee an efficient local network (Ref. 6).

Table n. 7 –Current situation of incoming and outgoing materials.

INCOMING/OUTGOING MATERIALS	**SITUATION**
Steelwork fumes+ zinc related waste	400-500 tons per day
Washed waelz oxide	150-170 tons per day
Slags	290-300 tons per day

Auxiliary materials used in the production process are: anthracite, coke, live lime (reagents added to the Waelz furnace), sodium carbonate (reagent crystalization plant), sulphuric acid, hydrochloric acid and dehydrated lime (pH correctives in water treatment plant), besides sulphuric acid (Waelz oxide pre-wash treatment) and 0 flocculants (cleaning plant).

Table n. 8 shows a list of substances and principle materials used in the plant, with related risk classification (Ref. 6). For each product and material used in Pontenossa there is an accompanying safety sheet, published in accordance with current standards. The Waelz oxide safety sheet is updated to 11.10.2012.

Table n. 8 – Substances used in the Pontenossa Plant.

Substances &/or prepared materials	Compounds present	Contents %	Identification symbols	Risk levels "R"
Waelz oxide	Zinc oxide	77 - 87	N (dangerous to the environment) T (toxic to reproduction)	R 33 R 61 R 62 R 52 / 53
	Lead oxide	4,5 -7,5		
Hydrochloric acid	Hydrochloic acid	> 25	C (corrosive)	R 34 R 37
Sulphuric acid	Sulphuric acid	94-98	C (corrosive)	R 35 R 41
Live lime	Calcium oxide		Xi (irritation)	R 41
Solvay soda	Sodium carbonate	≥98	Xi (irritation)	R 36

5.3. Storage of fumes and raw materials

Fumes in powder form arrive in tanks and are pumped directly into a silo measuring 350 m^3 or into two silos measuring 250 m^3 each and are then transferred pneumatically into the 350 m^3 silo for processing. Fumes also arrive by truck in containers that are regularly unloaded using a vibrating rough machining grate into a storage ditch. From here the material is taken out by means of an overhead crane with high tub and unloaded into storage hoppers. The ditch is completely insulated from the rest of the warehouse and sealed with translucent wall fixtures and corrugated steel sheets. The overhead crane is visually managed by an operator by means of tv cameras.

Storage takes place in ditches built of reinforced concrete inside warehouses covered and closed in order to avoid widespread dispersion of materials into the atmosphere and contact with rain water.

Lime is carried in tanks which pump the material directly into a silo and from there it is poured into the furnace using a sealed system that reduces emissions into the atmosphere to a minimum.
Coke arrives in trucks with tilting systems and is mainly stored under a roof closed on three sides and from where it is taken daily for loading the hoppers that serve the furnace. The standard quantities of coke present in the plant meet the 7-0 day requirements (< 1000 tons). A part of the incoming coke is stored outside. The humidity in the coke (on average 10%) keeps the pile compact and hinders any dispersion caused by wind.

To avoid the risk of accepting slags of radioactive waste by chance, all the materials entering the plant undergo analysis for radioactivity before being taken to their relative storage sites.

5.4. Production and management of contaminating waste

The production of waste mainly concerns the slags that come from the Waelz process. It contains iron (35-45%), lime (17-23%), silica (6-10%), manganese (2-3%), lead (0.4-1.5%) and limited quantities of zinc (< 2%). Other waste products come from routine activity (production, building maintenance both machanical and electrical, warehouse use of photocopier and computers) and from occasional activities such as construction and demolition of plants, out of order machinery and equipment (Ref. 6). With increased production, authorized by Regional Decree AIA n. 3403 del 4/4/2007, the quantity of slags produced reach values of 300 tons per day.

Slags produced by the furnace are sent to a basin where they are immediately extinguished in water and then picked up by a skip and deposited in an area inside the plant onto a concrete floor to be analyzed before going to the dump. Once analyzed, the slags are picked up by a mechanical shovel, loaded onto a truck and taken to the dumping ground. An admission test is carried out using L.C. 18 instructions (once S.W. 101087 rev. 2) in accordance with control boards (Ref 16).
In the Valle Rogno dumping ground waste disposal operations are carried out only and exclusively for the Waelz slags. The management plan for the dump is designed to take a quantity of Waelz slags up to 50.000 m^3/year (approximately 20 truck loads per day).

5.5. Emissions into the atmosphere

Emissions into the atmosphere come essentially from gas generated during the Waelz process (table n. 9).

Table n. 9. Emissions into the atmosphere.

EMISSIONS	ORIGIN	POLLUTANTS	DISPOSAL SYSTEMS	CHIMNEY HEIGHT (m)	CHIMNEY SECTION (m^2)
E14	Unloading (furnace and drum) + furnace loading line	Dust	Filter sleeve	24	0,5
E14/A	Unloading of Koch tower	Dust	Cleaning tower	24	0,6
E16	Waelz furnace chimney	Carbon monoxide (CO)	Filter sleeve, regenerative combustion	22	1,961
		Carbon dioxide (CO_2)			
		Ammonia (NH_3)			
		Total organic carbon (C)			
		Nitrogen oxide (NO_2)			
		Sulphur oxide (SO_2)			
		Cadmium (Cd) and compounds			
		Mercury (Hg) e compounds			
		Pb, Mn, Cu, Cr, V, Sn and compounds			
		PCDD/F			
		IPA			
		HCI			
		HF			
		Dust			
E18	Waelz oxide dryer	Dust	Filtro a maniche	17	1,13
		Carbon monoxide (CO)			
		Nitrogen oxide (NO2)			
E18/A/B	Furnace loading belt	Dust	Filter sleeve	8	0,02
E18/C	Loading line for lime from silo	Dust	Filter sleeve	14	0,09
E18/D/E	Furnace loading belt	Dust	Filter sleeve	10	0,02
E18/F	Furnace loading line	Dust	Filter sleeve	18	0,06
E18/G	Loading line for reagents from silos	Dust	Filter sleeve	12	0,09
E18/H	Waste cleaning line	Dust	Filter sleeve	9	0,28
E18/I	Loading line for silos fumes	Dust	Filter sleeve	17	0,11
E18/L	Loading line for silos fumes	Dust	Filter sleeve	17	0,11
E18/M	Loading line for silos fumes	Dust	Filter sleeve	8	0,08
E18/N	Loading line for silos fumes	Dust	Filter sleeve	12	0,09
E18/O	Loading line for silo A fumes	Dust	Panel filter	12	0,09
E18/P	Loading line for silo B	Dust	Panel filter	12	0,09
E18/Q	Silo waste for cleaning	Dust	Panel filter	10	0,09
E19	Fumes storage ditch	Dust	Filter sleeve	12	0,20

Before being released into the atmosphere, the gases go through a post-combustion plant where they are brought to a temperature of 900°C in excess of oxogen in order to enable the combustion of organic compounds that may be present. The plant and disposal technology for gases are fully described in the document entitled “Initial Environmental Analysis” (Ref n. 6) and in the technical attachment of the AIA Regional Decree 2010 (Ref 16). The plant works automatically. Combustion temperature is constantly measured and recorded. Emissions from the main chimney (E16) are constantly controlled by a monitoring system

that can measure the total organic carbon and the amount of gas coming out of the post-combustion tube.

Except for emission E14A which has a clearing tower, all the other emission points have a disposal system made up of sleeve or panel filters suitable for containing dusts. These emission points have differential switches connected to optical and acoustic alarm systems.

Tables n. 10-12 show data related to emissions from the main chimney E16 (authorized limits and average position), taken from company documents (Ref. 6) and from the tecnical section of authorized decrees, Ministerial Decree VIA 2005 (Ref. 24) and AIA Regional Decree 2010 (Ref. 16).

Table n. 10. E16 Chimney Emissions.

	Current Condition				**Future Condition**			
	Authorized limits		**Average position**		**Authorized limits**		**Average position**	
	Concentrat.	**Emission**	**Concentrat.**	**Emission**	**Concentrat.**	**Emission**	**Concentrat.**	**Emission**
Pollutants	***(mg/Nm^3)***	***(g/s)***	***(mg/Nm^3)***	***(g/s)***	***(mg/Nm^3)***	***(g/s)***	***(mg/Nm^3)***	***(g/s)***
NO_2	150	2,64	100,6	1,77	150	3,92	138.9	2,83
SO_2	50	0,88	0,1	0,0028	50	1,31	0,4	0,0081
COT	30	0,35	0,2	0,0035	30	0,52	0,5	0,0102
NH_4	20	0,53	2,5	0,044	20	0,78	0,5	0,010
HC1	10	0,18	1,2	0,021	10	0,26	3,5	0,071
HF	2	0,035	0,05	0,00088	2	0,052	0,001	0,00002
CO	-	-	71,3	1,26	-	-	58,2	1,19
Formaldehyde	20	0,35	0,09	0,0016	20	0,52	0,0003	0,0000
Acetaldehyde	20	0,35	0,008	0,00014	20	0,52	0,018	0,00037
Toluene	300	5,29	0,5	0,0088	300	7,83	0,0696	0,0014
Xilene	300	5,29	0,5	0,0088	300	7,83	0,0552	0,0011
Benzene	5	0,088	0,5	0,0088	5	0,13	0,0888	0,0018
PTS	5	0,088	0,09	0,0016	5	0,13	0,7	0,0143
Cu	5	0,088	0,0021	3.7E-05	5	0,13	0,0002	4.1E-06
Hg	0,1	0,0018	0,0008	1.41E-05	0,1	0,0026	0,0002	4.07E-06
Ni	1	0,018	0,0009	1.6E-05	1	0,03	0,0002	4.1E-06
Cd	0,2 (+)	0,0035 (+)	2.34E-06	4.1E-08	0,2 (+)	0,01 (+)	0,0002	4.1E-06
Pb	3 (++)	0,053 (++)	0,0016	2.8E-05	3 (++)	0,08 (++)	0,001	2.0E-05

Emission values refer to the following four scenarios: (i) Current gear situation, with maximum emissions authorized by the Region; (ii) current gear situation, with actual measured emissions; (iii) Future gear situation, with emissions authorized by the Region; (iv) Future gear situation, with actual measured emissions in a furnace loading position very similar to the future situation. Ministerial Decree DSA 2005/00925 (Ref. 24).
Note: (+) The authorized limit is excessive for the gear position with a maximum emission that can't exceed a concentration of 5 µg/Nm^3, which corresponds to a maximum flow of 88 µg/s in the current configuration and of 131 µg/s in the future one.
(++) The authorized limit is excessive for the gear position with maximum emission that can't exceed a concentration of 0.35 mg/Nm^3, which corresponds to a maximum flow of 0.0062 g/s (6.2 mg/s) in the current configuration and of 0.0091 mg/s (9.1 mg/s) in the future one (from VIA 2005).

Emissions contain gas compounds that come mainly from carbon combustion (NO_x, SO_2, NH_4, HCl, HF, CO, aldehyde, toluene, xilene, benzene). The dust present consists of 95-96% PM10 and 36-38% PM2.5 (Ref. 62).

From data regarding emissions using sample studies, the dispersion of atmospheric pollutants as far as the plant is concerned, has been calculated and various operative scenarios have been taken into consideration. Curves of isoconcentration of the chemical agents in the soil have been created and chemical agents examined. Results estimate a slight increase in reappearance in the soil but to an extent inferior to the authorized limits of the Lombardy Region. Over the whole area in consideration, the average annual concentration of NOx show maximum values in the range of 1 $\mu g/m^3$ (Table n. 11).

Table n. 11. Emissions of hydrogen oxide.

Current situation Actual emissions		Current situation Authorized emissions		Future situation Actual emissions		Future situation Authorized emissions	
Concentration ($\mu g/m^3$)	Distance (m)	Concentration ($\mu g/m^3$)	Distance (m)	Concentration ($\mu g/m^3$)	Distance (m)	Concentration ($\mu g/m^3$)	Distance (m)
28	209	42	209	30	209	41	209
13	504	20	504	21	524	19	544
13	544	19	544	17	544	17	524
12	581	18	581	12	781	16	581
11	524	17	524	12	754	15	504
11	807	16	807	12	328	14	807
10	256	15	256	12	504	14	754
10	754	15	745	<12	382-957	13	781
		<15	328-1253			13	256
						<13	328-1003

Maximum values of hourly concentrations in the soil are shown in the following four scenarios: (i) current gear situation with maximum emissions authorized by the Region; (ii) current gear situation with actual measured emissions; (iii) future gear situation with emissions authorized by the Region; (iv) future gear situation with actual emissions measured in a furnace loading position similar to a future situation. According to the measurements shown in the table, the following have been carried out; (a) simulated dispersion of a pollutant released into the atmophere in the four scenarios mentioned above; (b) reproduction of the curves of isoconcentration of the pollutant in the soil. Results almost always show a lesser increase of reappearance. The only significant increases of NOx have been recorded at a distance of about 500 mt from the chimney. Estimated average annual concentrations of NOx shows maximum values over the whole area in consideration in the range of 1 $\mu g/m^3$ (Ref. 24, from VIA 2005).

Table n. 12. Emissions of sulphur dioxide.

Current situation Authorized emissions		Future situation Authorized emissions	
Concentration ($\mu g/m^3$)	Distance (m)	Concentration ($\mu g/m^3$)	Distance (m)
17	735	26	735
16	1088	24	1088
16	382	23	382
11	1442	16	1442
10	524	15	524
10	923	15	923
		11	1795
		10	776

Maximum values of hourly concentrations in the soil are shown in the following four scenarios: (i) current gear situation with maximum emissions authorized by the Region; (ii) future gear situation with actual emissions measured in a furnace loading position similar to a future situation. According to the measurements shown in the table, the following have been carried out (a) simulated dispersion of a pollutant released into the atmophere in the four scenarios mentioned above and reproduction of the curves of isoconcentration of the pollutant in the soil. Results almost always show a lesser increase of reappearance. Increases in SO_2 can be calculated to approximately 50% for all distances (Ref. 24, from VIA 2005).

Estimates regarding dust, carbon monoxide and benzene show modest values of fall-out (maximum values < 0.08 $\mu g/m^3$ for PM10 and benzene, < 35 $\mu g/m^3$ for carbon monoxide). For lead, the average annual values in conditions of maximum authorized emissions show results no greater than 0.02-0.03 $\mu g/m^3$.

The most significant increases in expected levels of pollutants in the soil are found within the areas nearer the emission points. The only situations where, according to studies, the contribution of the plant could determine critical conditions refer to areas situated at about 200 mt, hence mainly within the plant itself (Ref.24).

In towns located in areas where values of fall-out are calculated, the measured levels of pollutants are maintained within values of between 0.02 e 0.6 $\mu g/m^3$ for NOx, 0.001 $\mu g/m^3$ for dust and 0.1-1,3 and 0,1 $\mu g/m^3$ for SO_2.

Table n. 13 summarizes emission data of pollutants during 2007-2010, measured using methods that take into account climatic conditions typical to the site (Ref. 6). Moderately high data have been measured for carbon monoxide, hydrogen oxide, mercury and PCDD/F, although they still remain under the emission threshold. Values relative to dust (PM10), hydrofluoric acid, hydrochloric acid, policyclic aromatic hydrocarbon, hydrogen oxide, amonia and carbon monoxide are maintained at low levels.

Table n. 13. Emission values calculated during 2007-2010.

From declarations E-PRTR (European register of emissions and transfer of polluting substances		2007	2008	2009	2010	Emission threshold (kg/a)
Emission	Parameter	Mass flow (kg/a)	Mass flow (kg/a)	Mass flow (kg/a)	Mass flow (kg/a)	
E16 + E18	Carbon monoxide (CO)	16.522	9.377	17.181	15.558	500.000
E16	Carbon dioxide (expressed in t CO_2)	82.977	80.775	92.114	80.597	100.000
E16	Ammonia (NH_3)	694	124	239	1.216	10.000
E16 + E18	Hydrogen oxides (NO_x/NO_2)	63,301	86.160	73.276	70.082	100.000
E16	Sulphur oxides (SO_x/SO_2)	4.269	1.490	6.063	2.472	150.000
E16	Cadmium (Cd)	0,051	0,099	0,315	0,030	10
E16	Mercury (Hg)	9,31	9,93	9,86	5,73	10
E16	PCDD/F (expressed as teq)	$0,175*10^{-4}$	$0,043*10^{-4}$	$0,339*10^{-4}$	$0,462*10^{-4}$	$1*10^{-4}$
E16	IPA	0,16	0,94	0,05	0,09	50
E16	HCl	1.543	3.139	1.101	677	10.000
E16	HF	221	353	255	287	5.000
ALL	Particulate (PM10)	1.751	1.580	1.832	1.650	50.000

Detailed information on emissions into the atmosphere exist for the E16 passage which is the most significant. There are twenty three more emission points of a lesser degree in the plant. As regards the particulate, their total contribution amounts to about 3.5 times that of the E16 passage (significant quantities of other chemical pollutants are absent in the 23 emission points). It could be said that an increase of 4.5-5 in the maximum values of simulated fall-out should provide a roughly representative measurement of the whole PM10 emission scenario.

In short, studies carried out at Pontenossa show that the amount of pollutants found in the atmosphere are limited. For all main pollutants except for hydrogen oxide, calculated values of fall-out in the area are one or more times inferior to the limits of D.Lgs. There is a fixed standard 155/2010 for the protection of human health (40 $\mu g/m^3$for hydrogen dioxide, 40 $\mu g/m^3$ for particulate and 125 $\mu g/m^3$ for SO_2). While considering the intrinsic limits of calculation models and the orographic complexity of the area under examination, estimates show that the Pontnossa plant makes a modest but constant contribution as far as impact on air quality is concerned.

The emissions contain chemical substances linked to atmospheric pollution from industrial activity. We have numerous scientific data on these polluting substances (Ref. 91,99) and an updated outline regarding their presence in industrial emissions in the EU (Figure n. 4). This enables a fairly precise assessment in terms of comparison as regards the impact that the emissions from Pontenossa have on the environment and public health which will be discussed later.

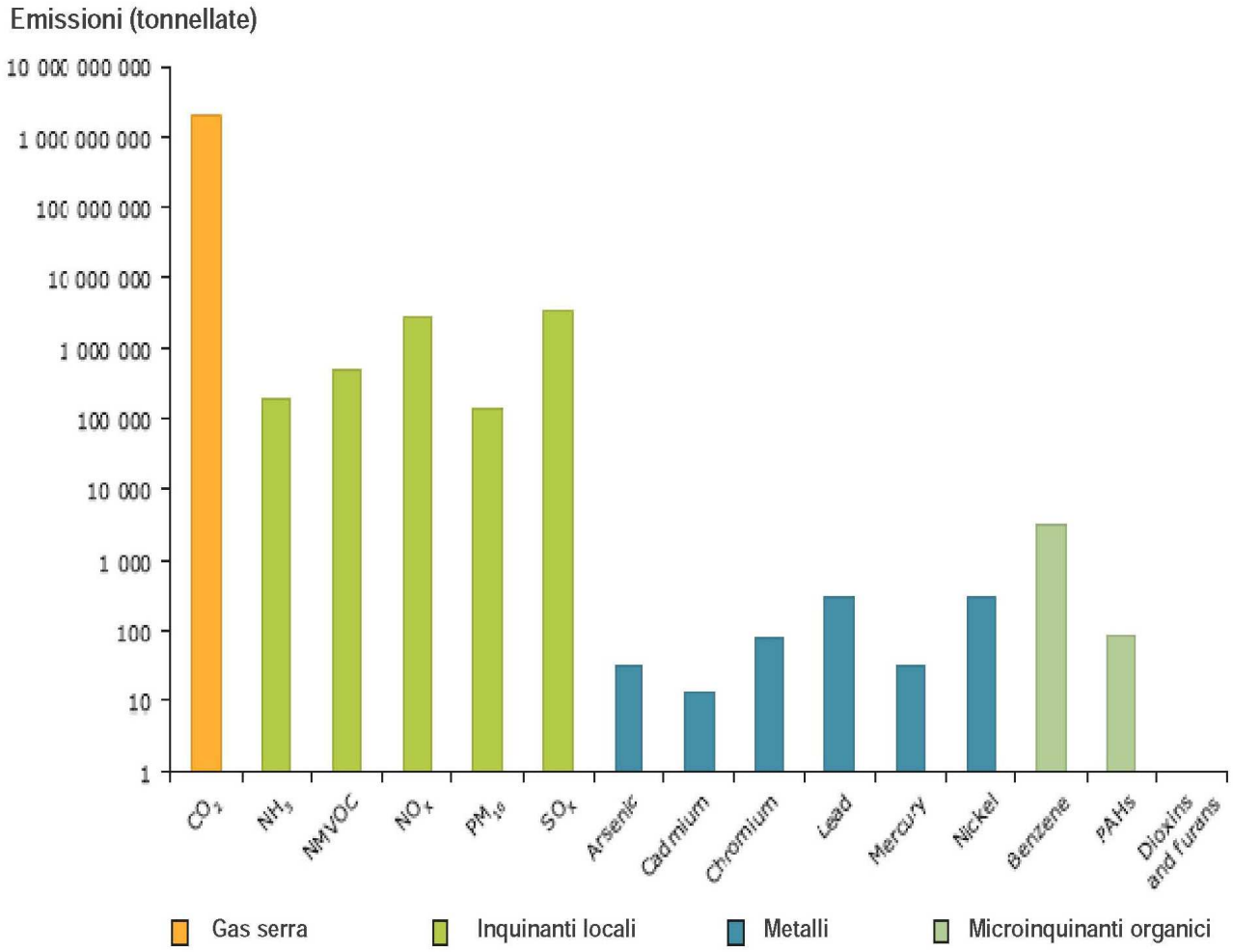


Figure n. 4. Grouped values of annual emissions of atmospheric pollutants in Europe (Ref. 91). Measurements taken from a total of 2000 major industrial plants. Note: values in the x-axis are in logarithmic scale.

5.6. Water Emissions

Regional Decree 2010 (Ref. 16) authorizes Pontenossa to take out a quantity of 460 m^3/h of water from the Riso and Musso torrents and from the so-called Crocifisso spring for the requirements of the plant (cleaning of Waelz oxide, cooling the slags and the Koch Tower). The Initial Environment Analysis document 2011 (Ref. 6) describes the phases of water withdrawal usage, the balance of water consumption inside the plant and water treatment systems illustrated in detail also in the Ministerial Decree DSA 2005/00925 (Ref. 24). An outline of water emissions is shown in Table n. 14.

Table n. 14. Outline of water emissions

DISPOSAL ABBREV:	LOCALTION		TYPES OF DISCHARGED WATER	DRAINAGE FREQUENCY			AMOUNT (m^3/giorno)*	RECEPTOR	DISPOSAL SYSTEM
	N	E		h/g	g/sett	mesi/ anno			
SC	5078865	1567916	Civil	24	7	12	-	Depurator Pontenossa Council	-
S1	5078820	1567545	Industrial, meteoric, perchlorate	24	7	12	9.240**	Riso Torrent	Chemical-physical
*** year of referral 2009** **** During periods of maintenance to the waelz plant, the amount of discharged water is reduced**									

Taken from Decree AIA> Regional 2010 (Ref. 16).

Water used during the process, that used for washing the forecourts and fresh rain water is collected and undergoes treatment in the depurator and filet plant before being poured back into the Riso Torrent. The perchlorate water from the dump is also taken to the depurator inside the plant. The necessary chemical and physical processes are used to speed up separation of the polluting elements.

The water depurator in the plant was set up in 1975 and underwent various improvements in 1991, 1996 and 2000. The most recent improvement has been the addition of reagent liquids for further disposal of heavy metals. Maximum current capacity of treatment is 600 m^3/h, of which 250 m^3/h is suitable for purifying with a speeding up process of metals in clear floctuants and final filtering. The remaining 350 m^3/h are sent directly for filtering on sand or carbon filters and don't need chemical or physical depuration treatment. There is an automatic cooling and self-emptying sample system for industrial refluent water disposal made available to control authorities. In order to monitor the efficiency of the water management system, a sample of the discharged water is carried out and analyzed daily.

The Company also has a water depurator plant for the rate of selenium found in steel work fumes (on average, 8 g/t). At present this plant has not proved necessary as the new technology used by the company determines the reoxidization of selenium in an insoluable form.

Since steel work fumes and consequently Waelz oxide contain chlorine, water from the oxide clearing process undergoes the necessary treatment aimed at reducing the concentration of chlorine in it.

In order to reduce the amount of potassium sodium chlorides in refluent water a new crystalization plant has been set up with an investment of 3 million Euros. This plant enables salt crystals to be produced by withdrawing them from the water that washes the Waelz oxide. The plant uses a concentrated solution of chlorides (sodium and potassium chloride) that comes from a section of the cleaning plant for Waelz oxide. With this system it is possible to separate about a third of all chlorides present in the wash water for waelz oxide (Ref. 6). The production of salt, pertaining to the concentration of chlorides in the solution sent to the crystalization plant, is in the range of 300 kg/h (Ref. 16). The plant has been in use since September 2010 at full production capacity, as will be illustrated later.

Authorization from Bergamo Province has set the amount of refluent purified water to be discharged into the Riso Torrent at 500 m^3/h. Pontenossa S.p.A. keeps an efficient system that measures the amounts of water in the Riso torrent in order to check that prior to industrial disposal the quantity of water in the torrent is equal to or more than 265 lt/sec.

Concentration of pollutants in the water discharged into the Riso torrent, according to results from chemical and physical analysis, are within the limits imposed by the D.Lgs. 152/06.

Pontenossa S.p.A. also is also in possession of a permit for the use of water for hydro electric and industrial purposes which can be taken from the plant at the source of the Riso and Musso torrents.
The water used by the hydro electric power station can vary and is conditioned by a minimum guaranteed amount to be maintained in both the Serio river (12 m^3/s) and in the Riso torrent (265 l/s). In periods of scarce rainfall the power station stops functioning so as to guarantee the equilibrium of the river eco-system.

6. IMPACT ON ENVIRONMENT AND LANDSCAPE

Data is available that enables an assessment of the local environment and the influence of pressure factors that effect it: data regarding air quality obtained from annual monitoring projects, monitoring of fish stocks and macrovertebrates near the plant, measuring the level of metals in the soil and in vegetation samples taken from different areas from the local territory.

6.1. Air quality

Studies carried out recently by Pontenossa S.p.A. are shown in Table n. 15.

Table n. 15. Monitoring studies of air quality carried out by Pontenossa in 2009-2012.

Toen/Location	Year	Period
Ponte Nossa	2009	23 November-1 December
	2010	18-24 November
	2011	30 November-29 December
	2012	8 June-7 July
Premolo	2009	13 November-21 November
	2010	10-16 November
	2011	30 November-29 December
	2012	8 June-7 July
Gorno	2009	3-11 December
	2010	26 November-2 December
	2011	18 November-17 December
	2012	8 June-7 July

The monitoring program is carried out in accordance with ministerial and regional laws, involving the towns of Gorno, Premolo and Ponte Nossa, in the vicinity of the plant (Figure n. 5). Assessment and points of referral are those laid out in Directive 2008/50/EC, known in Italy as D.Lgs. 155/2010.

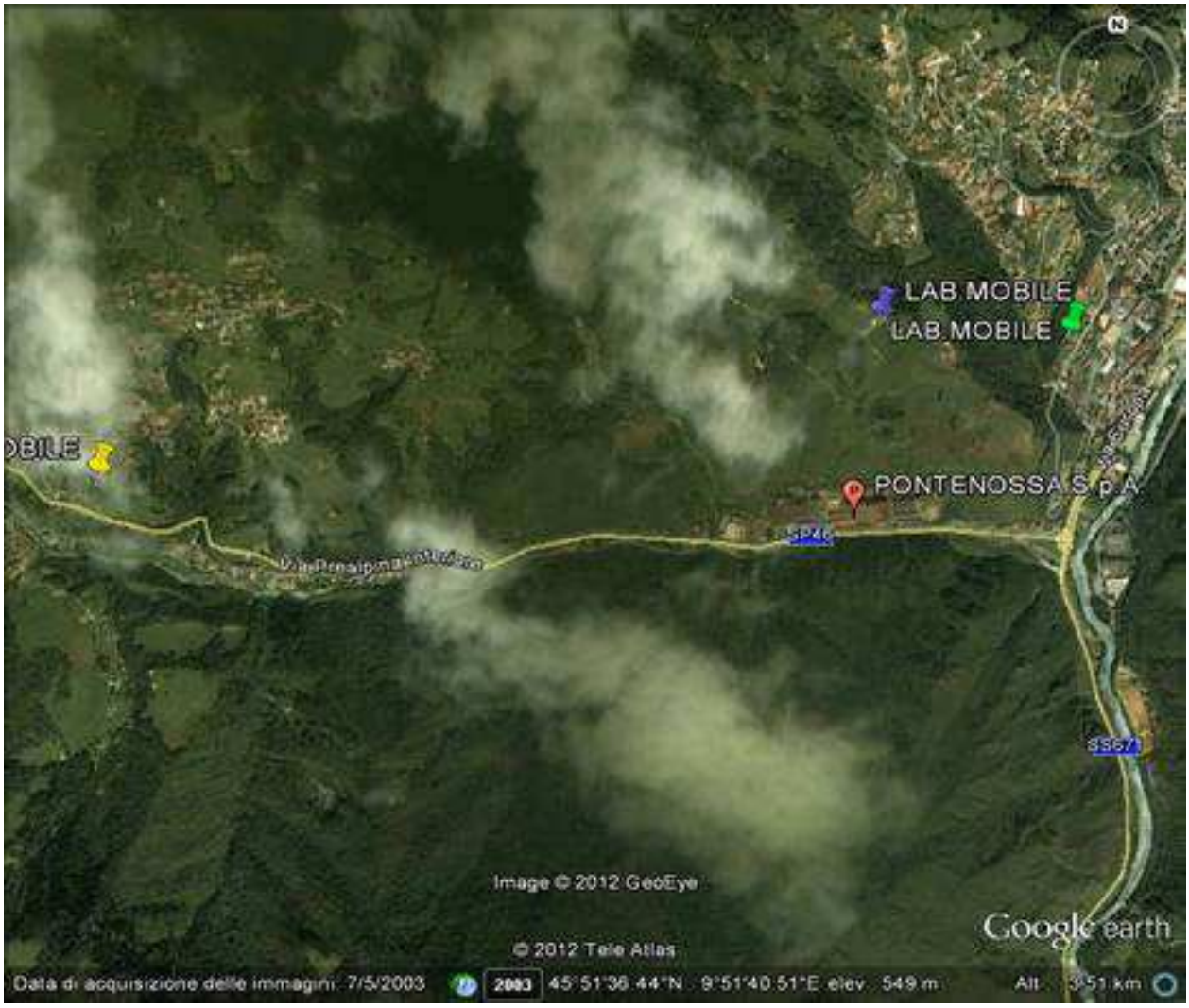


Figure n. 5. Monitoring of air quality. The map shows the position of the Pontemossa plant and the three monitoring stations (Premolo, Ponte Nossa and Gorno), indicated with blue, green and yellow drawing pins. The plant is shown with a red drawing pin (Ref. 76).

The most recent recordings were carried out in the summer of 2012. Data from the winter period, rather than the summer, are available for 2009-2011(Ref. 73-79).

Measurements refer to (i) average hourly values of meteorological data and concentrations of CO, NO, NOx, NO_2, SO_2; (ii) average daily concentrations of IPA (total amounts per kind), PM2,5 PM10, benzene, lead, zinc, nichel, cadmium, copper, mercury and arsnic; (iii) emissions from tower E16 of the plant, (iv) composition of perchlorate and on the average granulometry of dust released from the plant.

Concentration values of contaminating gases measured in summer 2012 (Table n. 16) are far inferior to the limits laid down by the law (D.Lgs 155 del 15/08/2010). Note the almost total absence of SO_2.

Values recorded in Ponte Nossa are slightly higher compared to those of Gorno (except for NO_2). Data recorded in Gorno are on a par with those of Premolo from 75° percentile downwards.

Table n. 16. Concentrations of contaminating gases measured in monitoring stations in the towns of Premolo, Ponte Nossa e Gorno. Air quality monitoring program, Summer 2012.

	NO	**NO_2**	**SO_2**	**CO**
	µg/m^3			**mg/m^3**
PREMOLO				
minimum	3	7	0,2	0,2
maximum	11	25	3	0,8
average	6	15	0,3	0,4
99° perc	10	21	0,6	0,7
90° perc	8	19	0,4	0,5
75° perc	7	17	0,3	0,4
50° perc	6	15	0,2	0,3
25° perc	5	12	0,2	0,1
dev stand.	1,4	3,4	0,2	0,1
PONTE NOSSA				
minimum	3	9	0,2	0,2
maximum	19	36	0,8	3
average	9	19	0,4	0,5
99° perc	16	31	0,8	1
90° perc	12	26	0,6	0,7
75° perc	11	23	0,6	0,6
50° perc	9	20	0,4	0,4
25° perc	7	14	0,2	0,3
dev stand.	2,7	5,3	0,2	0,2
GORNO				
minimum	2	5	0	0,2
maximum	35	28	0,8	0,9
average	7	16	0,3	0,4
99° perc	14	26	0,7	0,8
90° perc	10	22	0,5	0,6
75° perc	9	20	0,4	0,5
50° perc	7	16	0,3	0,4
25° perc	6	13	0,2	0,3
dev stand.	2,6	4,5	0,1	0,2

Calculated statistical values from a temporal series of average hourly concentrations of NO, NO_2, SO e CO.

Average levels of NO_2 recorded between 2009-2012 in air quality monitoring programs are also shown in a graph Figure n. 6. Concentrations measured in Premolo, Gorno e Ponte Nossa are well under the limits of the 40 µg/m^3 law.

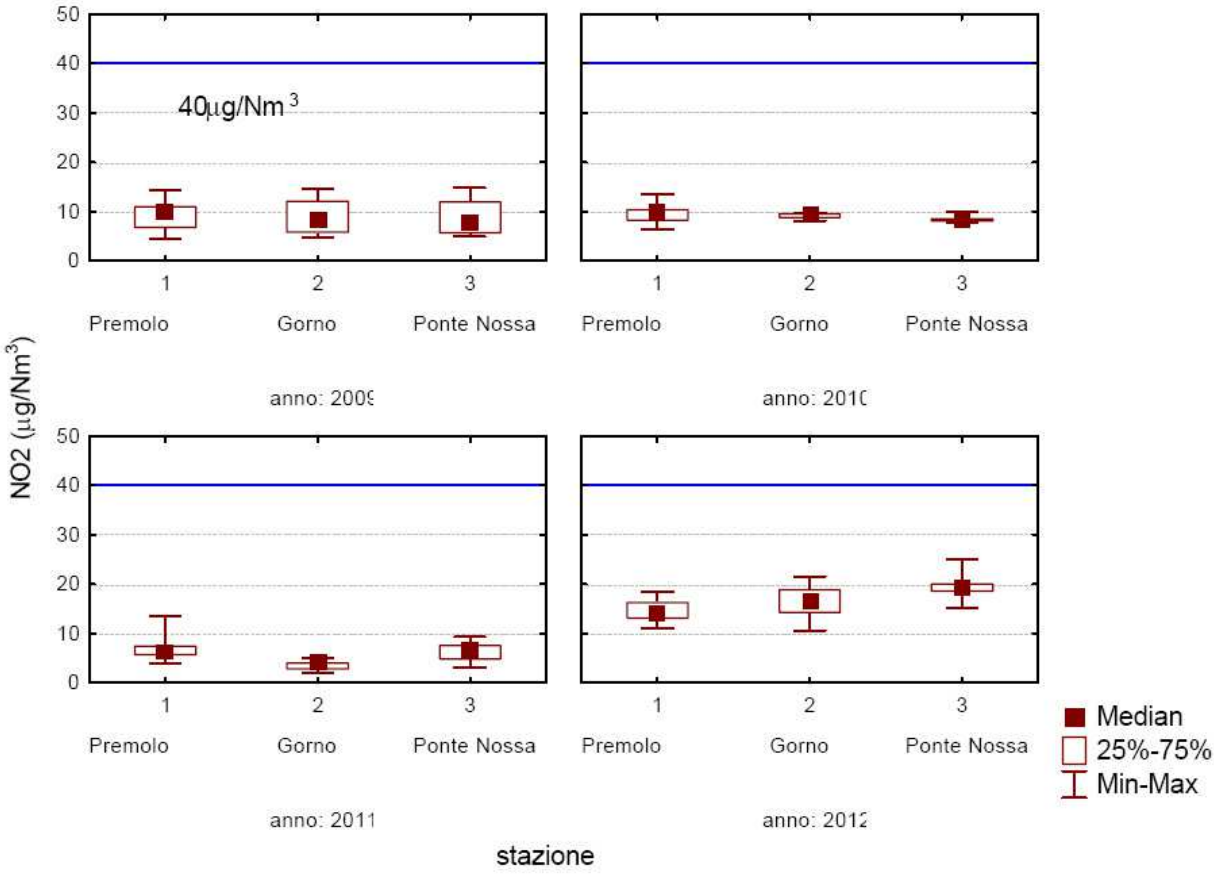


Figure n. 6. Levels of NO_2 recorded between 2009-2012 in air quality monitoring programs. The blue horizontal line shows the limits according to law (40 µg/m^3) set at an average for the calendar year.

Figure n. 7 shows average daily concentrations of PM2,5 and PM10 measured in 2012 in monitoring stations in the three towns.

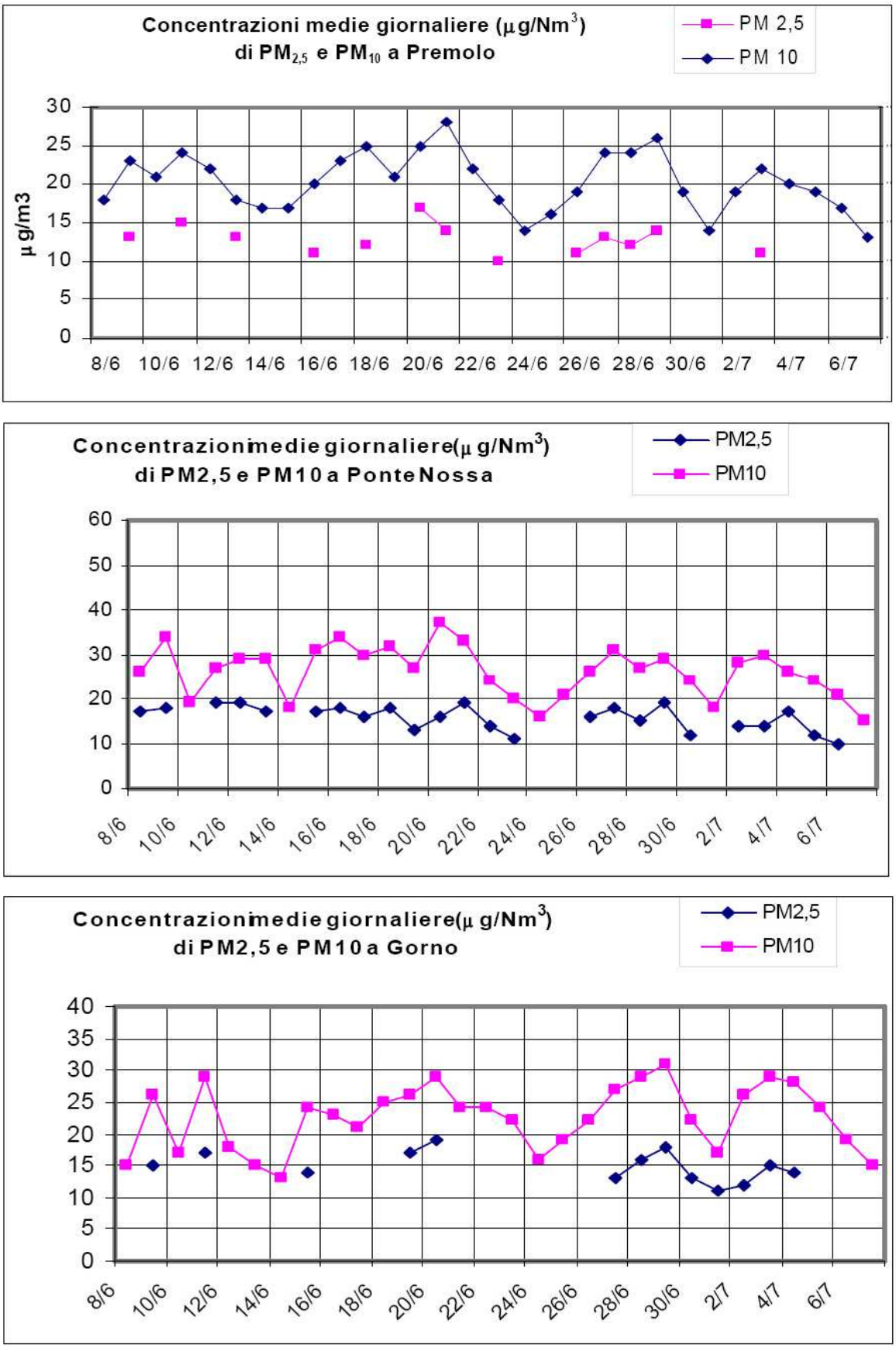


Figure n. 7. Concentrations of PM10 e PM2.5 recorded between June and July 2012 in the towns of Premolo, Ponte Nossa e Gorno.

We can see that average concentrations of PM10 always remain under a limited daily value of 50 μg/m^3. In Ponte Nossa, the maximum concentrations of PM10 (37 μg/m^3) reached, was measured on 20/06/2012.

Compared to data in summer 2012, the concentrations of PM10 measured between 2009-2011 tend to appear lower (Figure n. 8). A realistic explanation is the fact that PM10 typically increases in winter due to emissions from heating systems and cecausr of weather conditions which mean less dilution of pollutants present in the atmosphere. In 2011 there were some occasional increases in 50 μg/m^3 values in the stations of Gorno (3 times) and in Ponte Nossa (once).

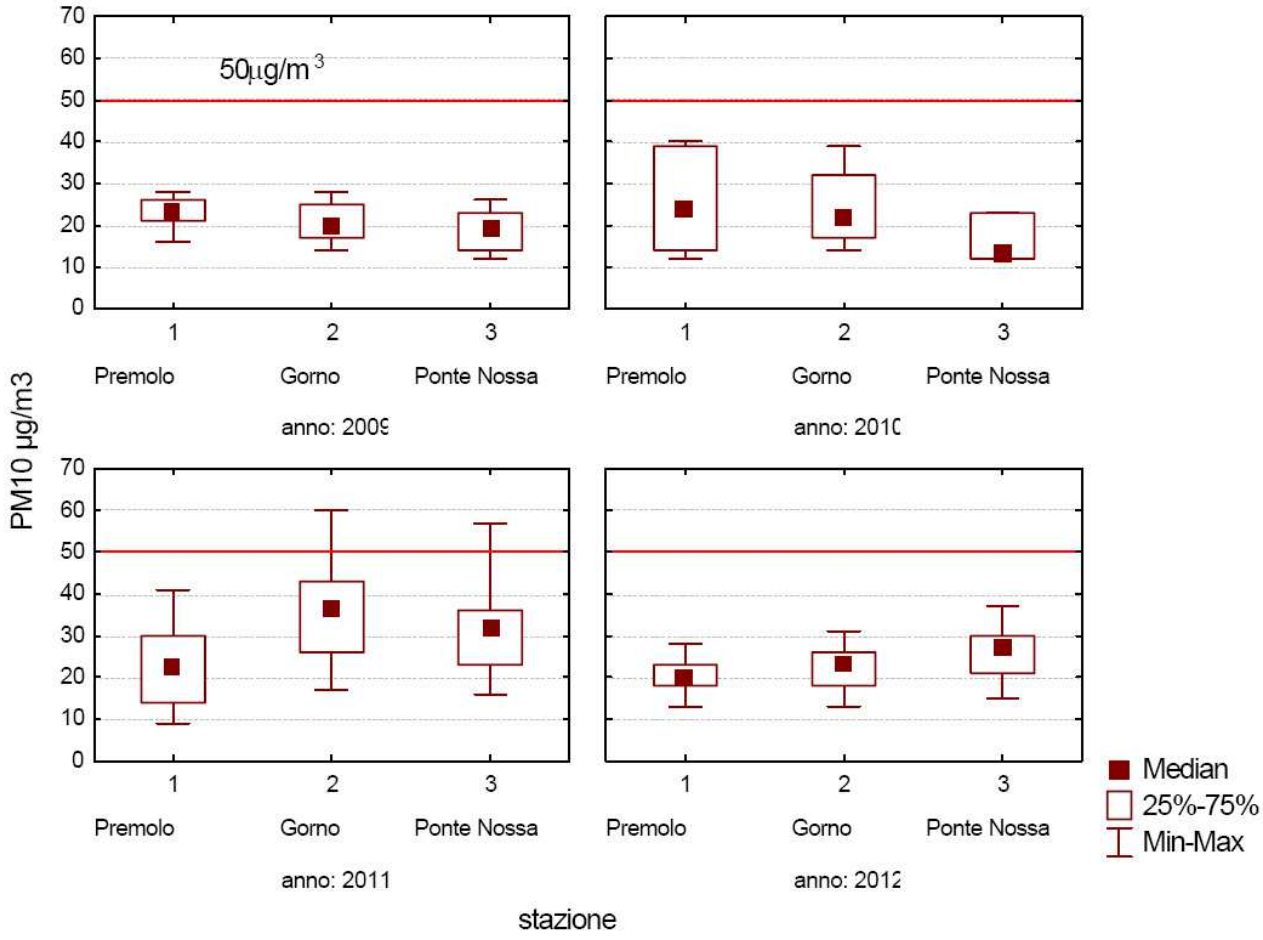


Figure n. 8. Levels of PM10 recorded in the monitoring stations of Premolo, Gorno and Ponte Nossa between 2009-2012. Programs 2009-2011 were carried out in the winter, and in 2012 it done in Summer.

From analysis of the metals contained in PM10 large quanties of zinc and lead have been found with lower levels of cadmium and copper (Table n. 17). The ratio of Zn/Pb in PM10 is generally equal to 12.7, with variations from 9.7 to15.7.

Table n. 17. Content of metals in the perchlorate (PM10).

ELEMENTO	CONCENTRAZIONE %	
	MAX	MIN
Zinco	63,00	55,00
Piombo	6,50	3,50
Cadmio	0,08	0,05
Rame	0,30	0,03

Figure n. 9 shows levels of PM2.5 measured in the monitoring stations of Premolo, Ponte Nossa e Gorno during the winter monitoring program 2012 and the summer program 2012. The average concentrations of PM2.5 are still under 25 µg/m^3, a value that will be the annual limit from 2015 according to the D.Lgs. law 155/2010 (for 2020, the standard foresees an annual limited value of PM2.5 equal to 20 µg /m^3).

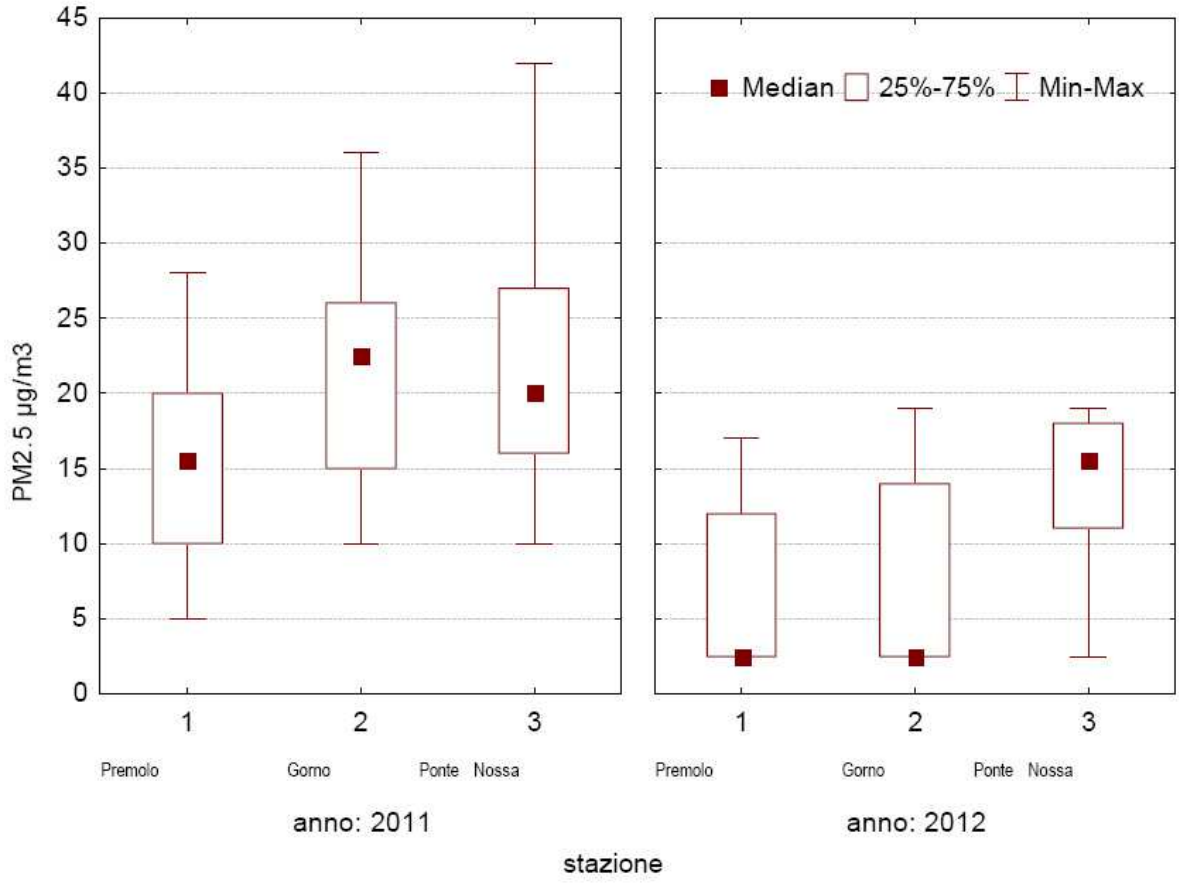
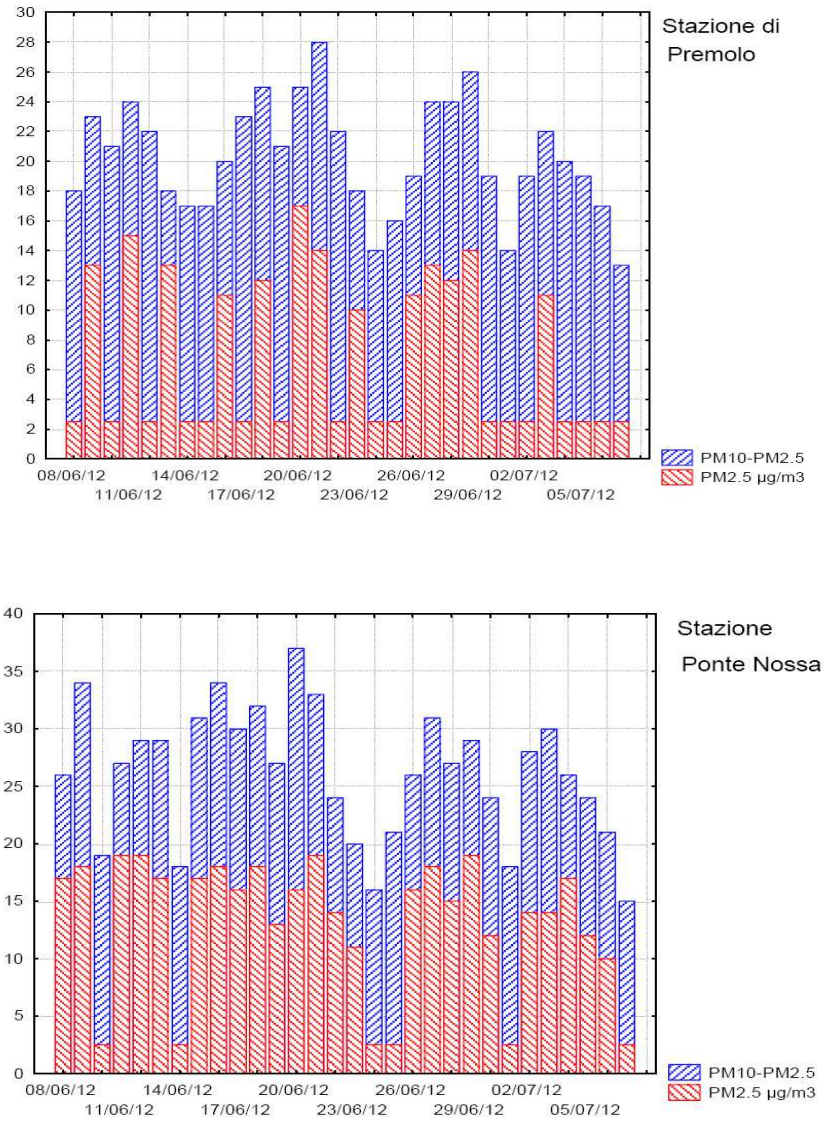


Figure n. 9. Levels of PM2.5 recorded in the monitoring stations of Premolo, Gorno and Ponte Nossa in 2011 e 2012. The 2011 program was carried out during the winter period and the 2012 program in summertime.

Figure n. 10 illustrates the ratio of concentrations of PM2.5 and PM10 measured during the 2012 summer monitoring program in the towns of Premolo, Ponte Nossa e Gorno. From the data, it would appear that in Ponte Nossa the supply of PM2.5 to the total concentration of perchlorate is higher compared to that of Gorno e Premolo.



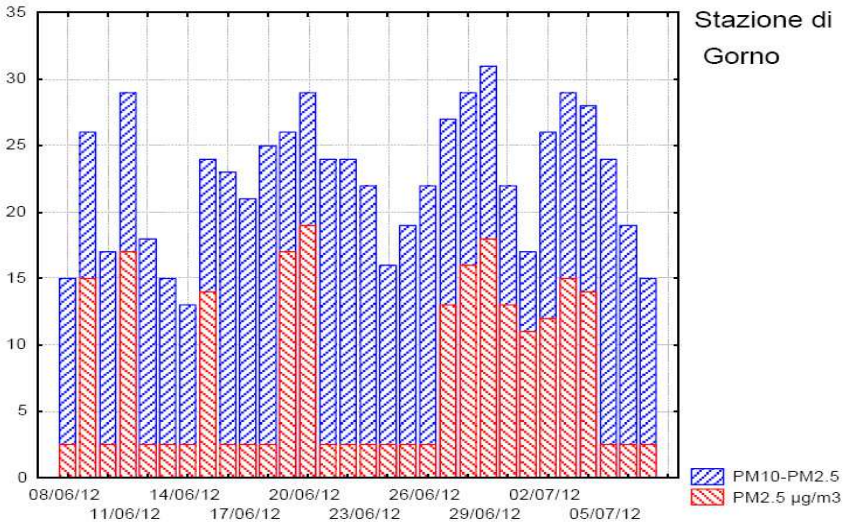


Figure n. 10. Relationship between PM10 and PM2.5 as seen in monitoring studies of air quality carried out in the summer of 2012 in the monitoring stations of Premolo, Ponte Nossa and Gorno.

In the monitoring studies carried out in Premolo, Gorno e Ponte Nossa between 2009-2012 also atmospheric concentrations of metals (zinc, lead and cadmium) were measured.
Levels of zinc measured in 2011 e 2012 reach values of 10-15 µg/m^3 (for this element the limited value hasn't been defined) and seem to be considerably lower compared to those of the previous period. (Figure n. 11).

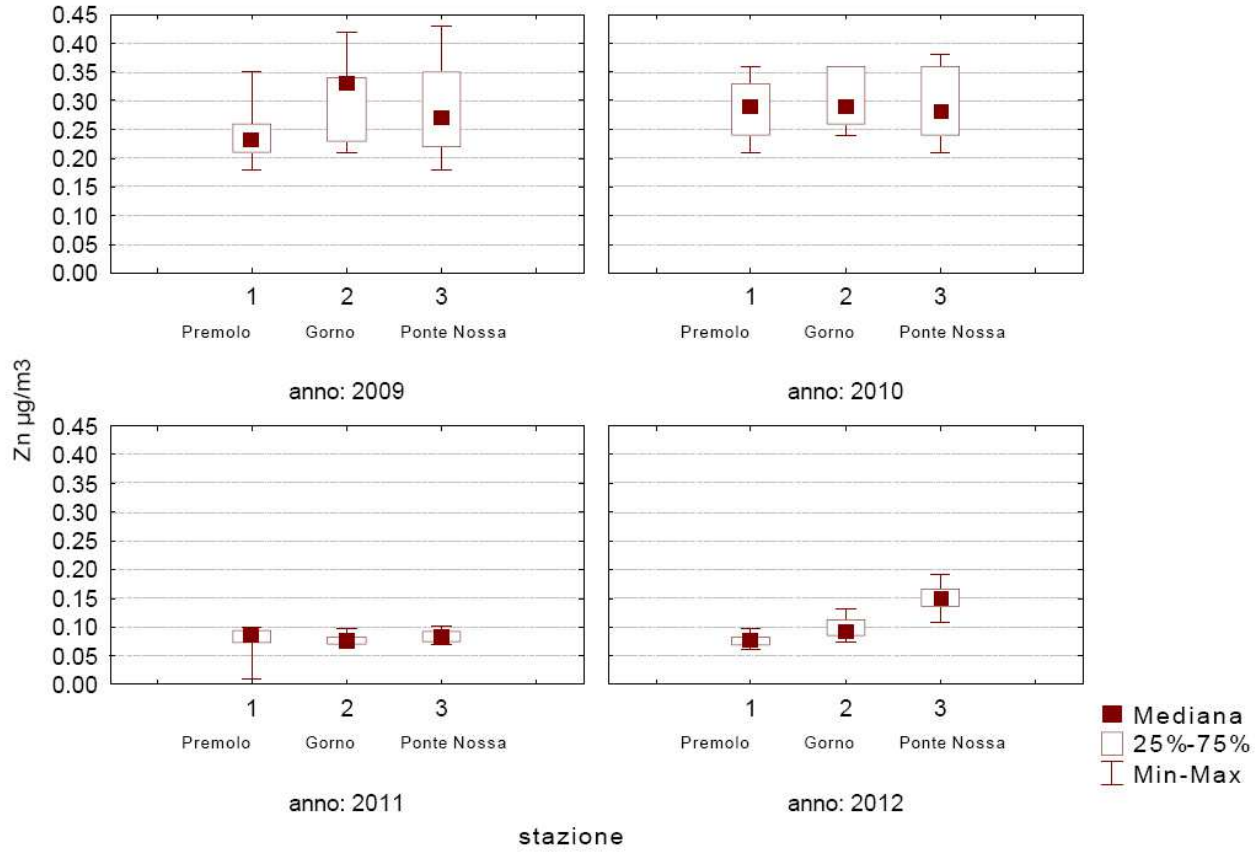


Figure n. 11. Atmospheric levels of zinc recorded during the monitoring program for air quality (2009-2012).

Lead, however, is found in invariabile concentrations under a 0.5 µg/m^3, a value that represents the average annual limit not to be surpassed (Figure n. 12).
Data from 2012 show levels of lead that are considerable lower than previous years (This appears evident mainly in Gorno e Ponte Nossa). Considering that lead tends to join with perchlorate, the differences could depend on seasonal factors such as a major concentration of atmospheric dust typical of winter (period in which the monitoring programs of 2009-2011 were conducted).

In Figure n. 13 the concentrations of cadmium measured in 2009-2012 are compared. This metal too has atmospheric concentrations that are very low.
An objective value was suggested for cadmium equal to 5.0 ng/m^3, similar to the total amount founed in the fraction PM10 of atmospheric perchlorate, calculated as an average of a calendar year.

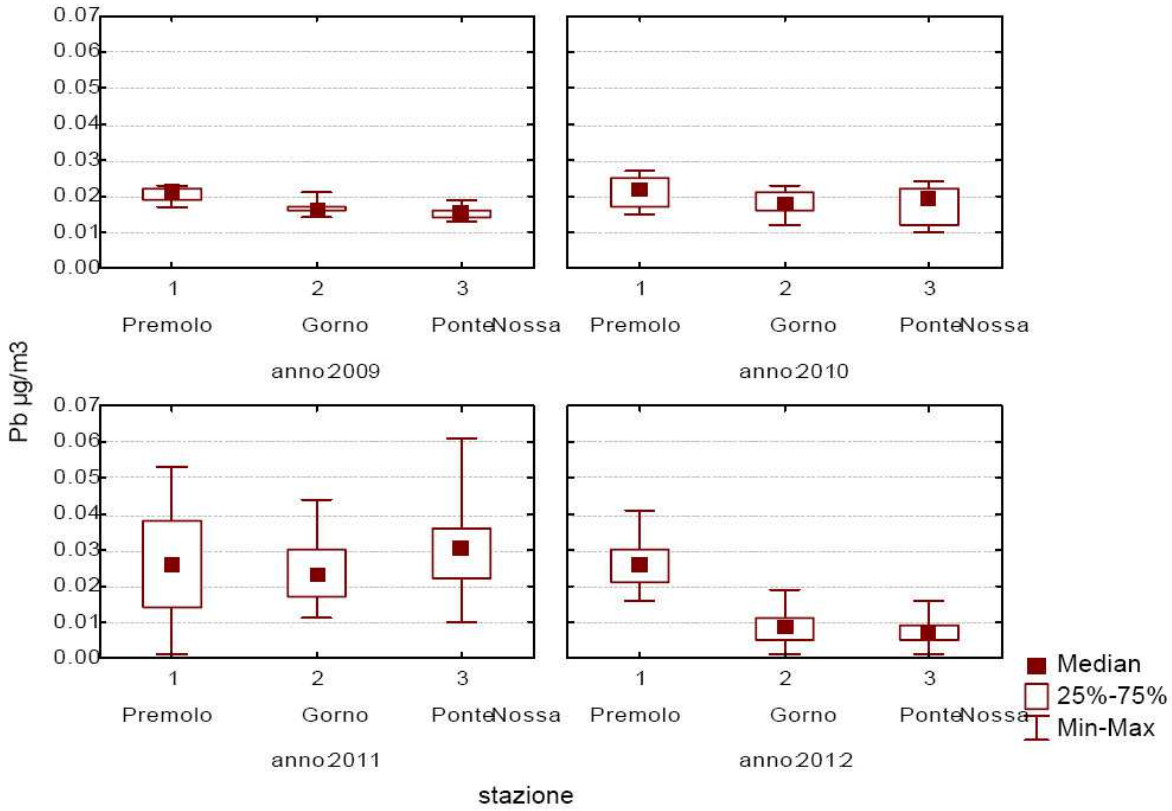


Figure n. 12.Atmospheric levels of lead recorded during air quality monitoring programs (2009-2012). Average annual level not to be surpassed is equal to 0.5 µg/m^3.

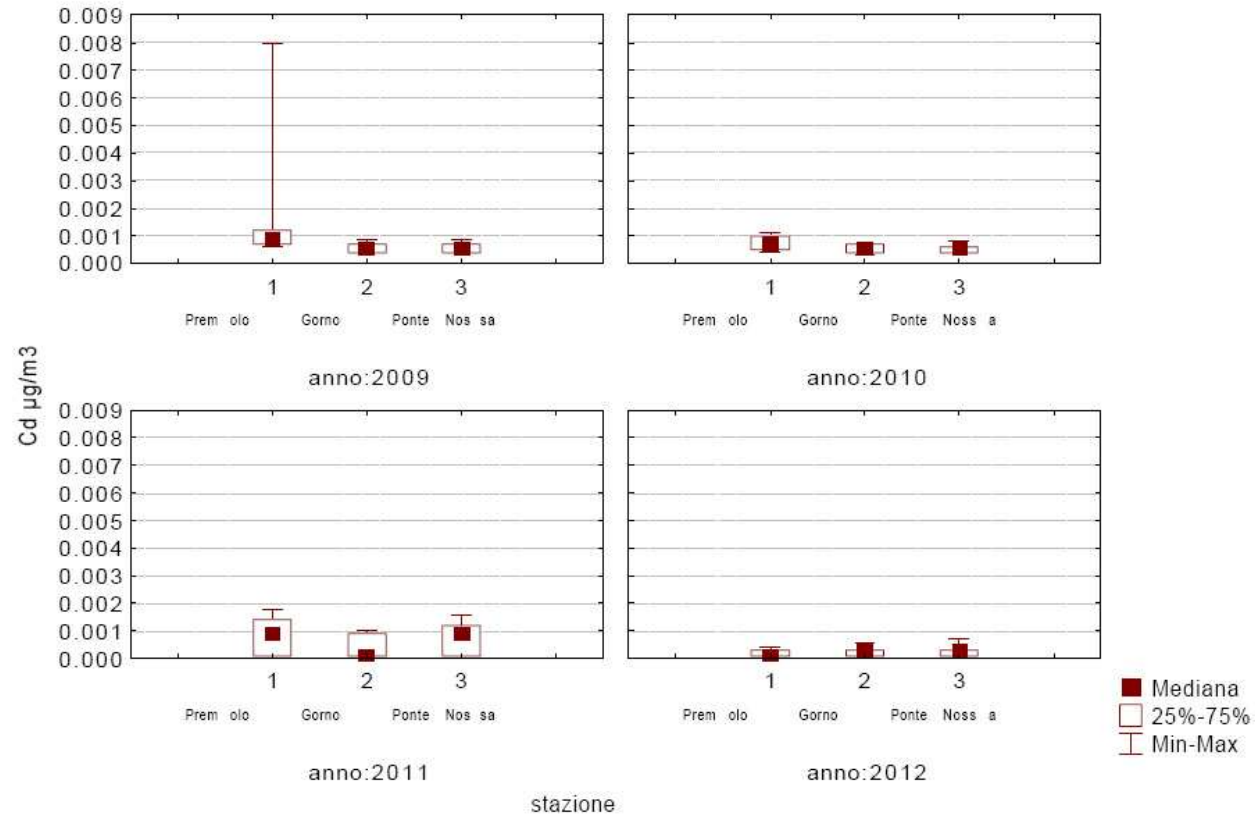


Figure n. 13. Concentrations of cadmium recorded between 2009-2012.

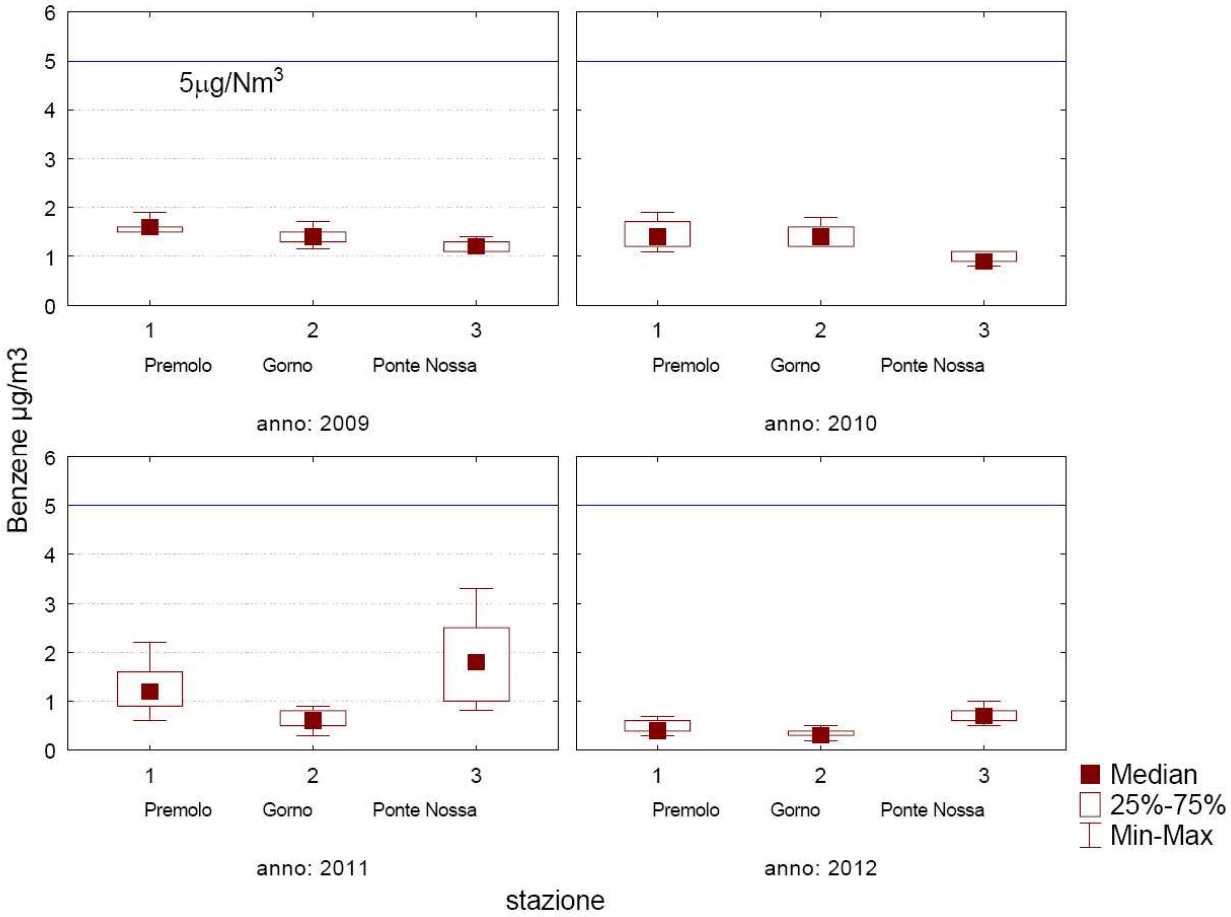


Figure n. 14. Concentrations of benzene recorded in the monitoring stations of Premolo, Gorno and Ponte Nossa between 2009-2012. Programs 2009-2011 were carried out in winter, the 2012 programi summer.

Levels of benzene measured in the monitoring stations of Premolo, Gorno and Ponte Nossa from 2009 to 2012 are considerably low (Figure n. 14)**,** if compared to the value limit (5 µg/m^3) set as a standard of air quality today.

Concentrations of atmospheric aromatic policyclic benzo(a)pirene hydrocarbons measured in summer 2012 in the three monitoring stations appear lower in quantity than those of the previous year (Figure n. 15). Also in this case, the phenomenon finds a plausible explanation for the fact that the monitoring programs were carried out in different seasons, a different season to the one where the monitoring took place (summer 2012 and winter 2011) Like metals, the aromatic polycyclic hydrocarbons tend to aggregate with the perchloate and it is consequently foreseeable that their concentration will diminish in summer in line with fine dust. The objective value of benzo(a)pirene is equal to 1.0 ng/m^3, referring to the total amount found in fraction PM10 of perchlorate material calculated as an average in a calendar year.

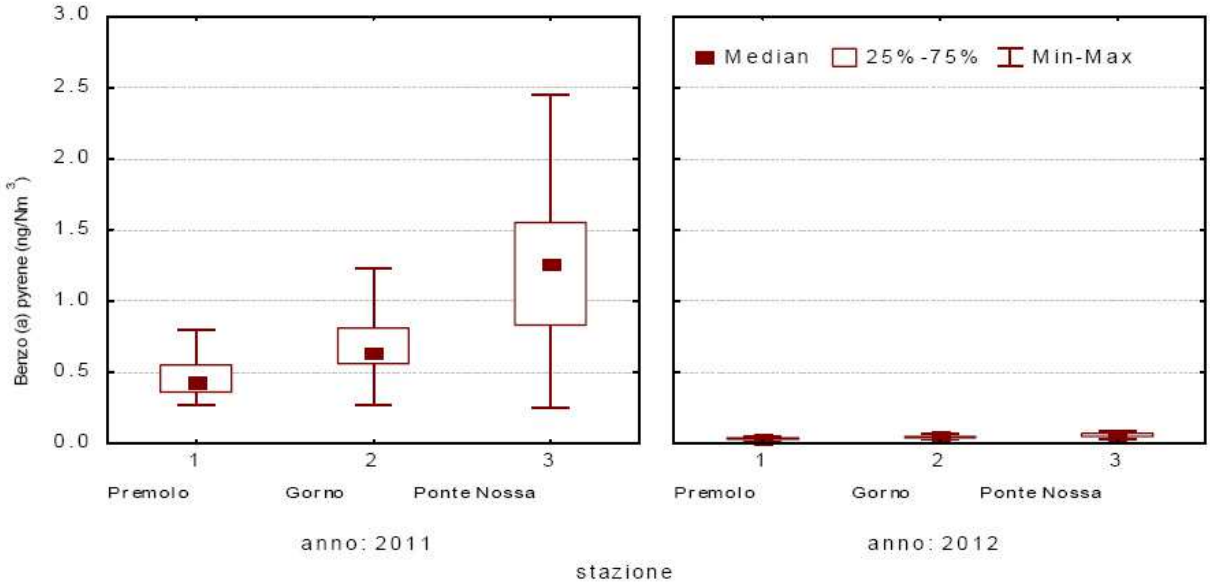


Figure n. 15. Comparison of concentrations of benzo(a)pirene measured in the monitoring stations in Premolo, Gorno e Ponte Nossa in 2011 (winter) and 2012 (summer). The objective value of benzo(a)pirene is equal to 1,0 ng/m^3, referring to the total quantity found in fraction PM10, calculated as an average in a calendar year.

In short, in 2012, as in previous years, the parameters of air quality have never surpassed the limits of annual or daily laws (when present). The 2012 summer program has highlighted different indices from those recorded during the monitoring programs carried out in the winters of 2009-2011, this can be explained by (i) reduced emissions by heating systems, (ii) different intensity to photochemical reactions, far more efficient in summer than in other seasons, (iii) the greater height of the inversion layer, which leads to greater reduction of polluting substances in the atmosphere.

The distribution of values measured in 2009 and in 2010 are substantially similar.

In the studies that have been illustrated (Ref. 76), the analytic data has been statistically elaborated using a lot of various analytic tests in order to check if the pollutants measured in the air can in some way be associated to emissions from the Pontenossa plant (measured at the same time in which recordings of air quality were carried out).

Table n 18 shows data referring to emissions of pollutants from chimney E16 at the time when the 2011 summer monitoring program took place.

From the results we can deduce that the emissions from the Pontenossa plant contribute only marginally to the total value of gas pollutants (especially hydrogen oxide) and dust measured in the atmosphere in the monitoring stations of Premolo, Gorno e Ponte Nossa.
Even the data regarding the ratio of concentrations of zinc and lead in the perchlorate tend to exclude significantly increased amounts from the plant emissions.

Table n. 18. Pollutants measured in emissions from chimney E16

SORGENTE	PORTATA (Nm^3/h)	INQUINANTI	VALORI LIMITE (mg/Nm^3)	VALORI (mg/Nm^3)
Camino forno Waelz – E16	63.960 ([1]) 47.700±29% ([2])	Polveri	5	<0,66([1])
		SO_x	50	7,6([1])
		CO	50	20,7([1])
		NO_x	150	143,2([1])
		COT	20	<1([1])
				3,0±55([2])
		Σ(Pb, Mn, Cu, Cr, V, Sn e composti)	3	<0,0035([1])
		Cd	0,2	<0,0002([1])

([1]) dati misurati il 06/12/2011 - ([2]) dati misurati dal 18/11 al 29/12/2011

On assessing this data, it is necessary to remember once again that the most recent studies (summer 2012) are not entirely comparable to those done in 2009-2011, the latter having been carried out in winter. Surveys, therefore, have to be completed before giving a definite interpretation to the results both in absolute terms and in relation to period trends.

However, environmental data obtained in the vicinity of the Pontenossa plant tend to provide an assessment of a general nature, especially if compared to those in other parts of the Lombardy Region or over the whole national territory. This comparison enables immediate recordings to be made, even if in approximate terms, of the amount of local atmospheric pollution and build up “variation maps” to compare other geographic and territorial situations including areas where health impact studies have been carried out that are associated to the levels of atmospheric pollution.

As an example, Figures n. 16 and n. 17 show representative data of average concentrations of PM10 and NO_2 measured in urban stations in the city of Bergamo during the winter periods of 2009 to 2011. Average concentrations of NO_2 measured in three recording stations in the winter periods of 2009-2011 (Figure n. 16) are definitely higher than those recorded in winter in the towns of Gorno, Premolo and Ponte Nossa, as described earlier.

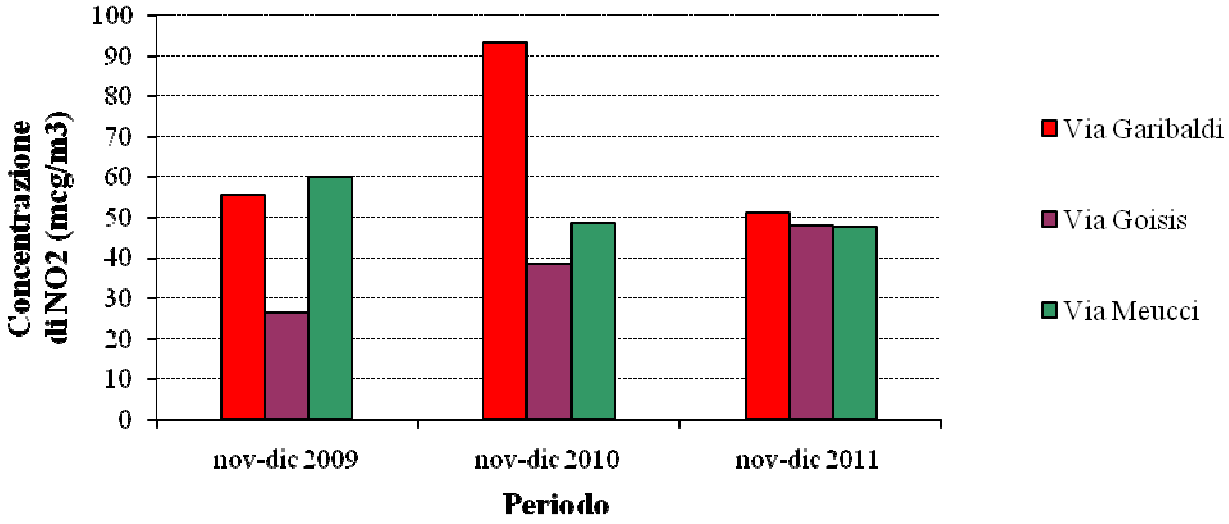


Figure n. 16. Average concentrations NO_2 measured in control units in Bergamo in the months of november-december 2009-2011.

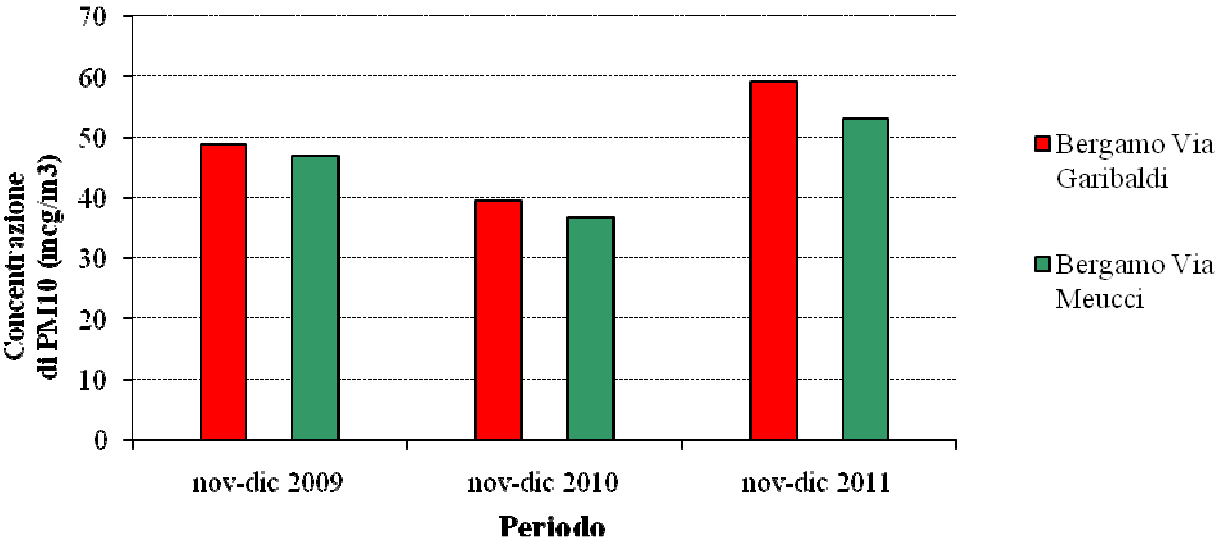


Figure n. 17. Average levels of PM10 measured in control units in Bergamo in the months of november-december 2009-2011.

Similarly, average levels of PM10 recorded in control units in via Garibaldi and via Meucci (values in the order of 39.4-59.2 μg/m^3 e 36.7-53.0 μg/m^3, see Fig. 17) are higher compared to those measured during the same winter season in the towns near the Pontenossa plant.

The same differences can be found when examining the average annual concentrations of PM10 recorded in the principle cities of Lombardy (Figure n. 18) or looking at the statistics showing the urban pollution in the atmosphere of all the principle Italian cities (Table n. 18).

Data about air quality will be discussed later on in an analysis relating to the impact of atmospheric pollution on people's health. Here, we are just concerned with a reminder about the national project EpiAir (Ref. 102), where a very complete picture emerges of air quality in the urban environment of Italy (Ref. 8, Ref. 101-103).
Average daily concentration of PM10 (2001-2005) is over 40 μg/ m^3 in 50% of the principle Italian cities and in almost all cities where the value of 50 μg/m^3 is surpassed for 35 days a year.

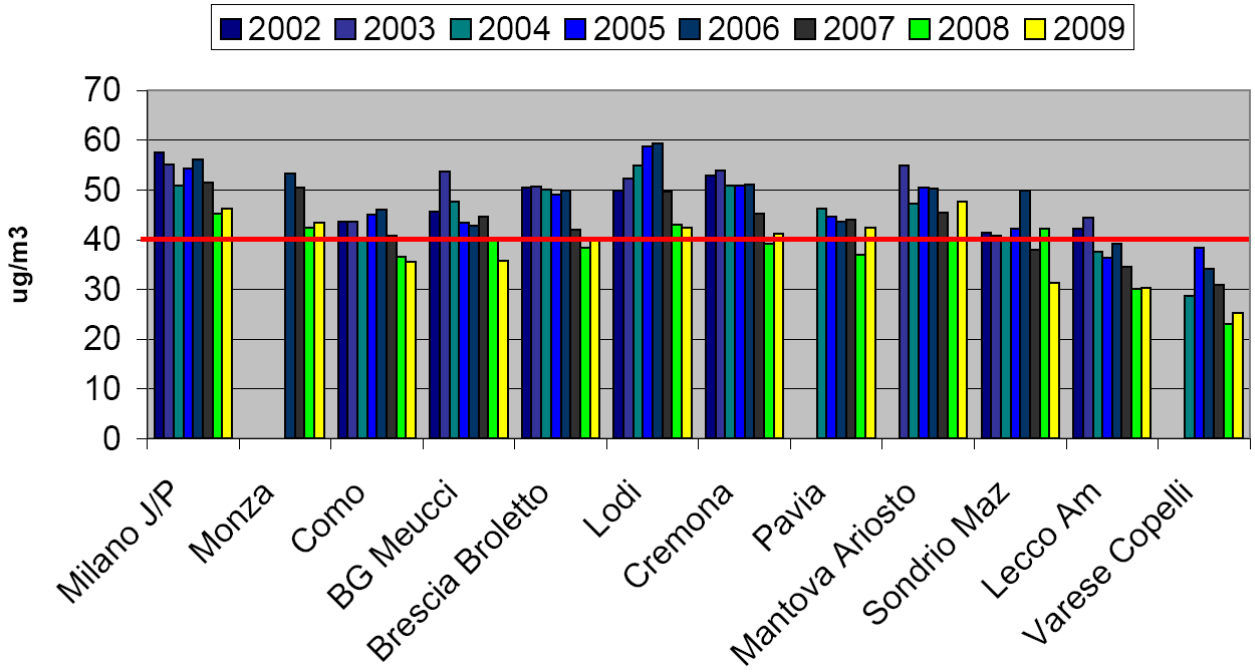


Figure n. 18. Average annual concentrations of PM10 recorded in the principle cities of Lombardy (2002-2009).source: ARPA Lombardia (www.regione.lombardia.it).

Table n. 19: Descriptive statistics of some of the atmospheric pollutants measured in Italian cities (Ref. 101).

Città	Periodo di studio	PM10 ($\mu g/m^3$) media giornaliera					NO_2 ($\mu g/m^3$) media giornaliera					O_3 ($\mu g/m^3$) massimo giornaliero delle medie mobili su otto ore				
		media	sd	range iq	50° pct	90° pct	media	sd	range iq	50° pct	90° pct	media	sd	range iq	50° pct	90° pct
Milano	2001-2005	52	32	37	43	95	59	23	30	57	88	91	34	43	89	138
Mestre-Venezia	2001-2005	48[a]	33[a]	35	39[a]	88[a]	38	14	18	36	58	91	30	37	88	131
Torino	2001-2005	54[b]	34[b]	46	43[b]	102[b]	66	20	25	64	92	115	39	53	113	170
Bologna	2001-2005	43[a]	25[a]	28	36[a]	76[a]	52	18	25	50	75	91	31	36	89	131
Firenze	2001-2005	38	18	20	35	61	46	19	22	44	68	96	24	30	96	125
Pisa	2001-2005	34	15	16	31	53	30	11	15	29	45	99	21	27	99	127
Roma	2001-2005	39	16	19	37	59	62	16	22	62	83	105	25	31	103	140
Taranto	2001-2005	50[c]	21[c]	28	48[c]	81[c]	26	11	14	24	41	78	21	30	78	104
Cagliari	2003-2005	30[d]	11[d]	14	28[d]	46[d]	35	16	22	34	57	81[d]	21[d]	26	78[d]	111[d]
Palermo	2002-2005	35	20	16	32	52	52	16	21	51	73	88	18	23	87	111

[a] periodo 2002-2005; [b] 01.06.02-31.12.05; [c] periodo 2001-2004; [d] periodo 2003-2004. sd: deviazione standard; range iq: range interquartile; pct: percentile

Nitrogen dioxide Il (NO_2) shows high daily averages in big metropolitan cities, with values over 40 $\mu g/m^3$ in Milan, Turin, Bologna, Florence, Rome and Palermo. Ozone is found in average concentrations over 90 $\mu g/m^3$ (average over an 8 hour period) in seven cities out of ten, surpassing values of 120 $\mu g/ m^3$ for more than 35 days a year.

Many elements indicate that road traffic is the principle factor responsible for this critical situation evident in these urban scenarios. (Ref. 102).

More useful data for assessing impact come from monitoring studies conducted by Pontenossa prior to 2009. This mainly refers to studies carried out in 2002 by researchers from Milan Polytechnic regarding emissions from the plant and the air quality in Ponte Nossa, Gorno e Premolo (Ref. 52). Different kinds of pollutants were measured: total overhung dust, PM10, metals (copper, cadmium, nickel, zinc, lead), benzene, toluene, xilene plus etilbenzene, formic aldeyde, acetic aldehyde, SO_2 and NOx. Results have generally highlighted the fact that all legal limits have been respected, with the occasional excess value of 50 $\mu g/m^3$ for PM10. Analysis of main compounds carried out on metals found in perchlorate leads to the exclusion of a considerable amount of dust being released from the plant of those measured in the three monitoring areas.

6.2. Local meteorological climatic features

Prevalent meteorological conditions in the area where the Pontenossa plant is situated can be deduced by the regular measurements carried out by the control unit within the plant (Figure n. 19). There are no local climatic conditions that could favour stagnant air. The behaviour of winds in the area are characterized by a fairly high force and influenced by high land. The dispersive capacity of the atmosphere finds no natural barriers as it does in many other industrial areas of the Padana plains where factors which hinder dispersion of pollutants (low force winds, frequent heat inversion and long periods of air stability and stagnation) are present and aid their accumulation both in winter and during the hottest months (Ref. 6, Ref. 16).

6.3. Hydro-geological and landscape aspects

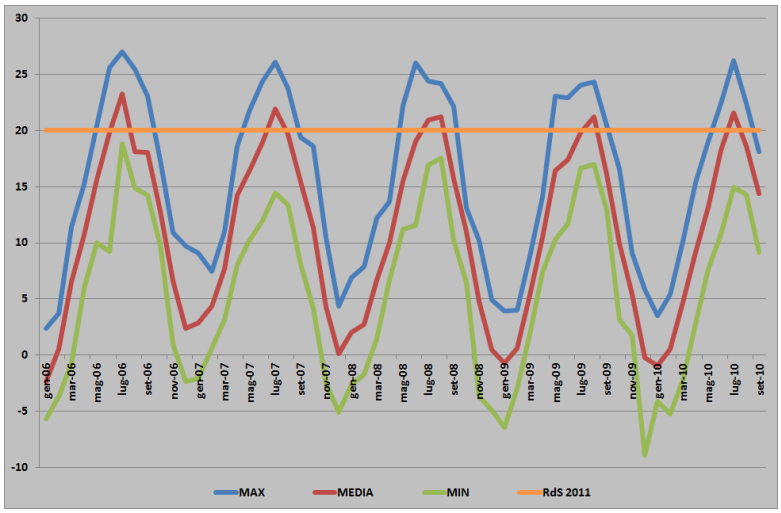
WATER WAYS. In the Regional Plans to restore health to the water as decided by the Lombardy regional Authorities (1996), the Riso Torrent has been classified in Class C for quality using control parameters (COD, BOD, N, P, SS) and Class B based on current use. As regards the river Serio, Class D quality has been determined using control parameters and Class B based on current use.

AIA Regional Decree 2010 authorizes Pontenossa take out approximately 1987 m^3/h from the Riso and Musso torrents for the requirements of the hydro electric power station and 353 m^3/h for the plant and a further 108 m^3/h from the Crocefisso Spring (Ref. 16). Consumption of water is however lower than the authorized amounts, also thanks to plant interventions that enable optimization of water recovery and minimize the amounts taken out.

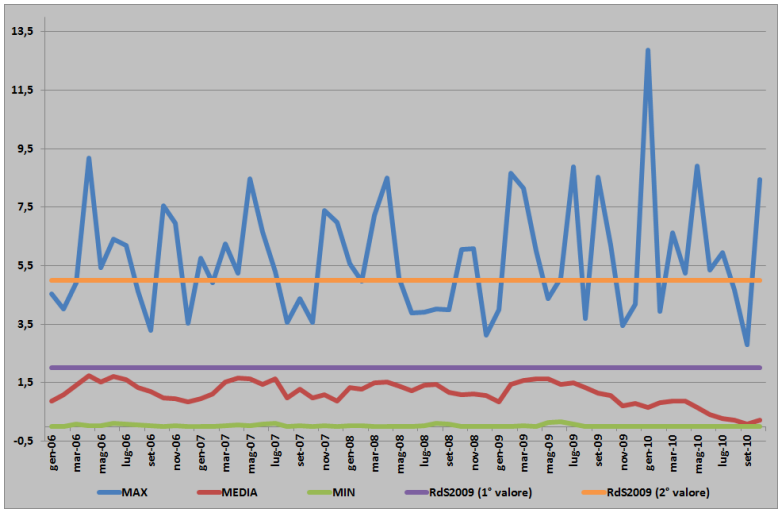
The water used during the productive cycles does not undergo substantial alterations to its own chemical characteristics. The water is restored to the Riso Torrent with a slight rise in temperature respecting emission limits in accordance with the current standards for water diposal in superficial waters. The plant's technology is such as to reduce considerably the amount of heat released in an acquatic environment and to maintain the chemical characteristics of the discharged water within acceptable quality limits.

As concentrations of chlorine are expected to be rather high in disposed water, water monitoring has to be done according to law as determined by Ministerial Decree VIA 2005 (Ref. 24), combined with the permanent functioning of the concentrations plant.

TEMPERATURE (°C)



WIND SPEED (m/s)



RELATIVE HUMIDITY (%)

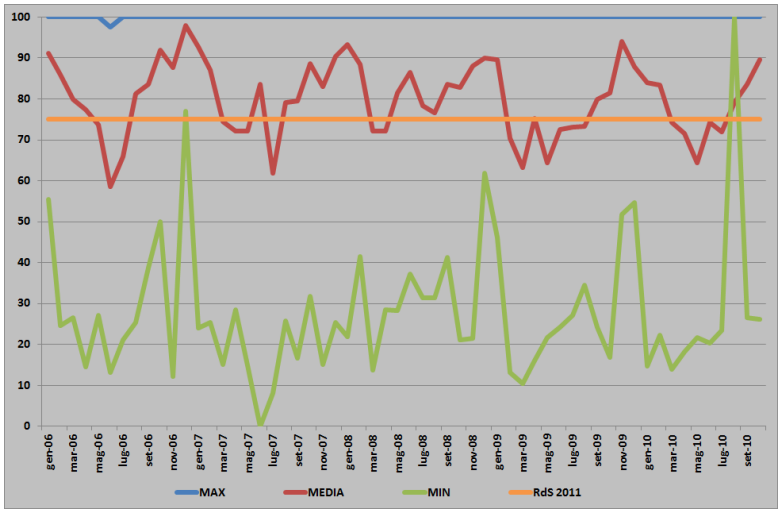


Figure n. 19. Main climatic conditions in the area of the Pontenossa plant. Values measured daily (temperature) or hourly (wind speed, relative humidity) from the control unit within the Plant (period 2006-2010).

Given that the ecological impact that the controlled deposit of waste could theoretically have on the risk of contamination to the superficial and subterranean, Pontenossa has put into action a water quality monitoring project (since 1995) of the Rogno torrent waters and the water at riverbed level found under the existing disposal site. With the foreseen enlargement, the company will provide a draining net under the impermeable sheet (these will be placed on the new Rogno torrent riverbed) and some perchlorate gathered at the bottom over the impermeable sheet (these will be taken, together with the current quota of perchlorate, to the company depuration plant). Some necessary work will be done to make to obtain an impermeabile barrier that will stop contamination of the soil due to waste deposit.

SOIL. Available data does not show risks of a hydro-geological type with reference to the superficial waters of the Riso torrent. The plant is located within the third sub-area of the Upper Seriana Valley Mountain Community. The P.C.U.M., whose regulations are respected by local planning permission, don't experss any particolar criticism. The area around the plant has been classified as stable and isn't situated near areas of instability.
New urban areas are not planned around the plant, except for the joining up of the small nucleus of houses around the Val del Riso and Ponte Nossa junction (Ref. 16).

Some metals that can also be found in current production processes and are characteristic of the natural geological context of the area where the Pontenossa plant is situated. This is due to the presence of metal mineralization in the subsoil particularly mineral reserves of zinc, and lead which, as mentioned previously, were mined until the end of the 70s last century. This geo-chemical background has been under examination even in recent monitoring studies related to the content of metals in plant species as will be illustrated later.

IMPACT LINKED TO THE ENLARGEMENT OF THE DISPOSAL SITE. The disposal site enlargement project will not have any relevant impact on the landscape. The places involved by the project are only partially visible in a short piece of road at the bottom of the valley. The visible part includes the area of the dump that has already been covered by natural growth and part of the future area to be built up. The company ultimately aims to recuperate the morphological aspects and the roof of the dump will be such as to mitigate the visual impact enabling it to blend into the environment.

No historical or cultural elements have been interfered with. In the VIA Regional Decree 08/07/2009 (Ref. 23) it is evident that there are no potential negative interferences between the proposed project and environmental issues.

The Incidence Test carried out by Pontenossa in accordance with DPR 120/2003, has not shown significant impact on SIC Val Nossana, Cima di Grem (Grem Heights), relating to the activities of the plant and the disposal site enlargement project (Ref. 24).

6.4. Species of flora and fauna

Modifications to flora and fauna could be attributed to atmospheric pollutants from emissions (eg. NOx) or from contamination of water ways such as the Riso torrent that flows opposite the entrance to the plant.

The bio-monitoring program that Pontenossa has set up is considered to be necessary to check on species of flora and fauna that have been selected as indicators of the quality of the local eco-system.

6.4.1. Monitoring of fish stocks and macroinvertebrates. Studies were entrusted to a specialized Centre of Bologna University (Centre for the Technology and Hygiene of Intensive Breeding of Small Species). A technical document from December 2011 (Ref. 51) describes the results of observations regarding the Riso torrent taken in four different recording stations: (i) in the proximity of Oneta's urban centre, (ii) in the town of Gorno in two places (iii) on the mountain side and (iv) on the valley side of the Pontenossa plant (Figure n. 20).

The survey took into consideration morphometric features and the ecological division of areas, the conditions and consistency of fish stocks, the physical and chemical characteristics of the water and the composition of the macrobentonic fauna. The Index for Widespread Biotics (Indice Biotico Esteso: IBE) was determined and the levels of metal pollutants, with an aim to check for any effects on the consistency of fish stocks and on macroinvertebrates living in the torrent's waters.

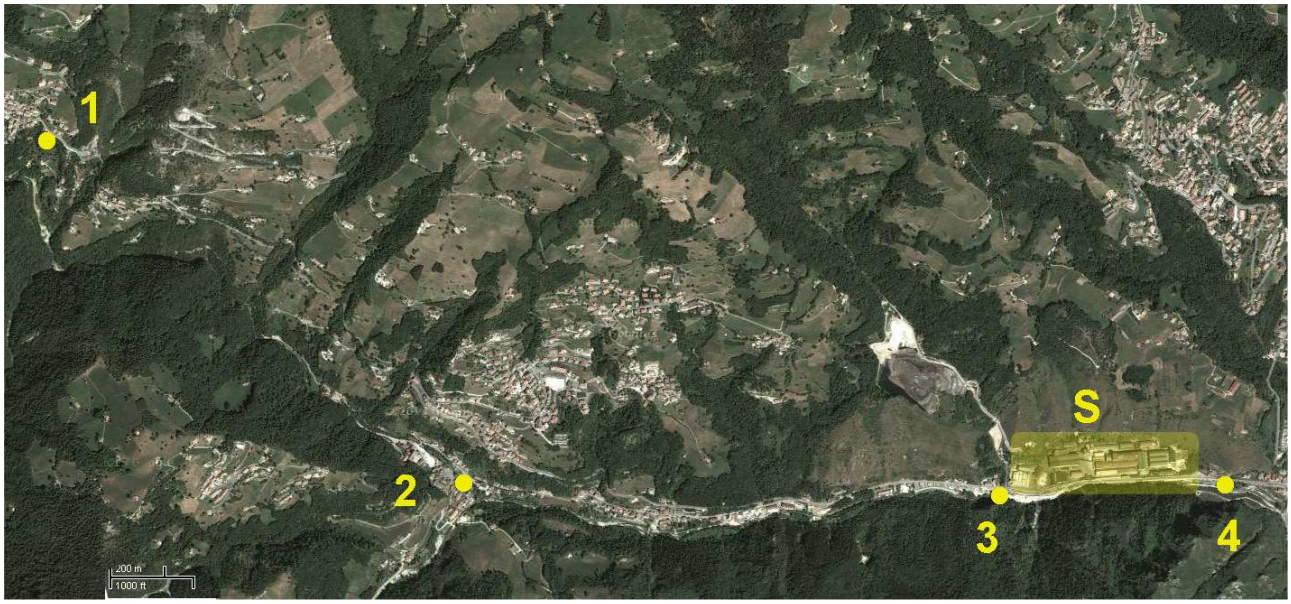


Figure n. 20. Monitoring Stations of fish stocks and macroinvertebrates in the Riso torrent: (1) in proximity of Oneta's urban centre, (ii) in the town of Gorno and in places(3) above and(4) below the Pontenossa plant.

In the station above the plant, the concentration of metals (cadmium, lead, zinc, copper, nickel, mercury) is low, often not higher than that recorded in the station above. Other data regarding the station below the plant, show a satisfactory level of water quality which has improved its classification compared to previous years from stations n. 2 and n. 3.

The best indicators of the quality and integrity of the eco system were identified on the mountain side of Oneta's urban centre. In the station situated a few hundred meters below the previous one (an area where the torrent receives significant effects from the urban centre of Gorno), the conditions of the acquatic environment have shown to be sub standard with an absence of the more sensitive macrobentonic species the presence of species well known for their capacity to withstand high levels of pollution.

Fish stocks in the Riso torrent consist mainly of Fario trout (*Salmo trutta morpha fario* L.).

6.4.2. Monitoring of metals in the soil and in leaf samples. In further studies levels of metal in the soil and in leaf samples taken from towns near the plant were measured (Ref. 59). This program is in accordance with the regulations included in the Pronounced Decree for Environmental Compatibility (DEC/DSA/2005/00925, Ministry of the Environment and Protection of the Territory, 12.09.2005, Ref. 24), taken from Decree n. 3403 of the Integrated Environmental Authorization issued by Lombardy Regional authorities in 2007 and confirmed in following AIA Decrees. These are considered of significant importance as instruments to keep environmental pollution under control both for the fact that contamination of the soil and plant life can have an effect on human health and on zootechnical heritage. Certain metal pollutants in the soil tend to be absorbed by plants, even some grown for eating purposes or join with dust that is consequently inhaled. Contamination of the soil and plants by potentially harmful metals is the subject a vast quantity of scientific literature (Ref. 15, Ref. 117, Ref. 118) and from where useful information can also be obtained to analyze the first pieces of data collected from the area around the Pontenossa site.

Company research, in agreement with the ARPA Department of Bergamo, was carried out by a firm called Arethusa (Curno, Bergamo) between the end of september and October 2009.

An area of 5 km wide with a stretch of 1 km^2 was under examination with the Pontenossa site at the centre and including the end of the Riso torrent and Central Seriana Valley. This is an area where you can find a variety of territorial circumstances both built up and rural (towns of Ponte Nossa, Parre, Premolo, Gorno and relative districts), downstream areas of the river Serio, rocky and wood covered hillsides. Altitudes range from 414 mt. above sea level (eg. downstream Serio to the south) to 1000-1200 mt (Belloro heights).

For a period of about ten days, samples of birch leaves (*betula pendula or alba*) were collected together with a soil sample from the nearby area (without foliage). A selection of metals to be examined (iron, copper, alluminium, cadmium, chrome, nickel, lead and zinc) was done by taking into account plant activities in order to identify any possible processes of industrial pollution.

Initial results confirm that levels of metal found in the soil correlate with the geology of the area characterized by metal reserves and the natural widespread increase of zinc, lead, cadmium and copper. We shouldn't however exclude the fact that soil data also reflects the current and past presence of industrial sites concerned with mining, using and manufacturing metals. This situation is true mainly for zinc and lead which have been the principle metals found in both metal reserves and in waste from industrial activities.

Firstly it is important to remember that accepted maximum soil screening levels of metal pollutants come from studies made by authoritative international sources such as the American Board for Environmental Protection (AEP). The proposed values are a benchmark for examination of ecological and eco-toxic repercussions relative to soil contamination (plants, wildlife, invertebrates etc.) and to evaluate the need to put into action decisions to restore health to ground that has been polluted by industrial activity. (Ref. 111).

Following that, the first results to be obtained are summed up in the bio-monitoring of metals conducted by Pontenossa. Furthermore, a biological and toxicological interpretation of the data is given based on current scientific knowledge and guide lines from International agencies.

Alluminium. This metal has been recorded in soil and leaves in variable concentrations from one sample site to another. In leaf matrices average values equal to 149 mg/kg (milligrams per kilogram) have been found. The highest concentrations in the soil are found on hillsides and in urban areas. High quantities of aluminium are to be found naturally in the ground. Industrial processes and other human activities (e.g. carbon combustion) aid the way for metals into the environment. When absorbed by plants, aluminium can cause a slowing down in root growth and hinders the use of nutrients in the subsoil.

Cadmium. In soil chemistry, cadmium is generally associated with zinc. The metal is absorbed by roots and leaves and accumulates in organisms in the soil. Industrial processes where lead, copper and metal plating are used are examples of anthropic activities that lead to significant emissions of cadmium.

Major concentrations of cadmium (in soil and leaf matrices) were measured downstream of the Riso torrent, particularly in the sample station located near the plant's service car park. Average values of cadmium were found to be equal to 0.47 mg/kg in the leaves and 3.32 mg/kg in the soil.

The Ministerial Decree for the Environment DM 471/99 concerning polluted sites (Ref. 110) has set up maximum values of cadmium equal to 2 mg/kg s.s. (dry substance) for use of soil in green and residential areas and 15 mg/kg s.s. for commercial and industrial use. These values have been proposed to both limit accepted maximum levels of soil screening for contaminated soil and for drainage purposes.

The amount of cadmium in leaves, which has been assessed here as an index of pollution, also offers indirect guidelines on the risks to human health considering that metal tends to concentrate itself in many vegetables destined for eating purposes.
EC Regulation n. 1881/2006 of 19 December 2006 establishes the maximum amount of cadmium as equal to 50 µg/kg (micrograms per kilogram) for meat (beef, pork, lamb, chicken), 100 µg/kg for cereals, 200 µg/kg for rice, 50 µg/kg for vegetables, fruit and wild mushrooms (all values refer to the weight of fresh food).

Should the concentrations of cadmium monitored by Pontenossa and found in birch leaves be found also in food, these values would be over the accepted limits. Tolerated daily doses (TWI) of cadmium that can be ingested with food equals 2,5 µg/kg of bodyweight, i.e.175 micrograms/week for a person weighing 70 kg (Ref. 107).

Chromium. Chromium is a dangerous pollutant but in small concentrations it can have useful biological effects on the organism. It strengthens the functions of insulin and benefits the intermediate metabolism (carbohydrates, proteins and fats). In hexavalent form it is toxic for animals and pants. As numerous types of soil are rich in chromium, absorption into plants is very limited. The form of chromium most biologically suited to plants is the hexavalent type. Steel production, metal plating, paint production, waste incineration and leather dyes are amongst the most common human sources of environmental contamination.

Suggested food intake is around 40 µg Cr^{3+} per day (Directive 2008/100/EC). For an adult, the normal daily dietary amount ranges between 60 and 160 micrograms (Ref. 94). The main food sources containing chromium are sea food and crustaceans (20-120 µg of chromium/100g of food), wholemeal flour, mushrooms, broccoli and tomatoes (15-20 µg of chromium/100 g of food).
Pontenossa monitoring studies have shown average amounts of chromium in the soil equal to 40.7 mg/kg. Ministerial Decree DM Environment 471/99 regarding polluted sites (Ref. 110) establishes different values for soil types used for green and residential areas or for commercial and industrial purposes. Total chromium values (proposed both as limits for contaminated soil as for benefic aims) are 150 mg/kg s.s. for soil use in green and residential areas and 800 mg/kg s.s. for commercial and industrial sites.

In leaves, average values of chromium equal to 0.59 mg/kg were found, with higher concentrations located near the Pontenossa plant and in the town of service car park Casnigo near Ponte del Costone restaurant. The greatest concentrations in leaf samples are those measured downstream of the Riso torrent, as opposed to what has been observed in the soil where major concentrations were measured in the south western zone. The amount of chromium found in leaf matrices surpasses the standard concentrations measured in products destined for human consumption.

Iron. The soil contains high quantities of trivalent iron. By reducing it to bivalent iron, the metal is absorbed into plants and transfered to the leaves where it helps chlorophil synthesis and other biological activities to take place. Iron reduction is hindered in ground containing high pH (7.8-8) or with high amounts of active lime.

Pontenossa monitoring studies show average levels of iron equal to 166 mg/kg, with some excess levels which mainly concern samples collected near the plant's service car park.

The greatest concentrations of iron in the soil were found in samples taken on the hillside above the Riso torrent. In the leaf matrices the highest levels were measured downstream with secondary peaks to the north and south west.

Nickel. This metal is rapidly absorbed into the soil and is found in plants. There is no certain evidence of its effects on metabolism, although a positive action on growth has been described. Common sources of emission are the combustion of fossil material, founderies, and use of phosphatic fertilizers.

This present study shows that nickel is found in soil in average concentrations of 35.5 mg/kg. Average leaf concentration is equal to 0.99 mg/kg. Values exceeding the average are measured in Ponte Nossa, near the plant's service car park and in the Bondo district of Colzate.

The natural level of nickel in soil is quite high in some parts of Italy, reaching values that are much higher than those established by Directive 86/278/EC. The latter, like the D.Lgs. 99/92, sets a maximum limit of concentration of nickel in the soil equal to 75 mg/kg s.s. The Ministerial Decree for the Environment D.M. 471/99 regarding polluted sites sets different values on the content of nickel in the soil according to whether it is used for green and residential areas or for commercial and industrial purposes. Suggested values are given as limits for both soil contamination and drainage purposes. These values are 120 mg of nickel/kg s.s. for soil used in green and residential areas and 500 mg of nickel/kg s.s. for commercial and industrial purposes.

In the area around the Pontenossa plant, the quantity of nickel recorded in leaves is lower than the standard amount found in some types of food (eg. 1440 µg/kg in beans, 1900 µg/kg in lentils), and higher in others (e.g. 20 µg/kg in mushrooms, 200 µg/kg in spinach and wheat flour). The area with higher concentrations of nickel in leaf matices and partly confirmed also in soil, is located in the north and south west.

lead. The presence of lead in the soil is due to natural processes of decomposition of geological substrata ,atmospheric fallout processes and human activity. Lead is found in plants as a rule but doesn't have a biological role. This metal is not absorbed by the soil very much and its transfer from the roots to the top of the plant is limited.

In soil samples taken near the Pontenossa site average concentrations of lead equal to 197 mg/kg were measured, with values far above the average in two monitoring stations (In the northern pastures of Trevasco mountain and downstream of the Riso torrent). The D. Lgs. 99/92 and Direttiva 86/278/EEC both set maximum limits of concentrations equal to 100 mg of lead/kg s.s. and 300 mg of lead/kg s.s. with the aim of re-using it on waste soil.

The Ministerial Decree for the Environment D.M. 471/99 regarding polluted sites sets different values on lead in the soil depending on whether it is used for green and residential areas off or commercial and industrial purposes. Suggested values (as limits for soil contamination and drainage purposes) are 100 mg/kg s.s. for soil use in green and residential areas and 1.000 mg/kg s.s. for commercial and industrial purposes.

Leaf matrices show definite characteristics in samples taken downriver. Average concentrations of lead in the leaves is equal to 7.69 mg/kg. Highest levels have been recorded near the plant's service car park. EC Regulation n. 1881/2006 of 19 December 2006 sets the maximum level of lead in foods, fixing a value of 20 micrograms of Pb/kg for baby foods (e.g. raw milk) and 100 micrograms Pb/kg of product for leafy vegetables and mushrooms. However, the situation should raise concern if edible vegetables contain concentrations of lead similar to those measured in the leaves near the plant.

Copper. This is an essential element for plant life. In animals it plays a role in proteic metabolism and connective tissue. Daily intake is in the range of 1.2 mg. Copper complements zinc: it is absorbed by the same mechanism as zinc so that one element can inhibit the absorption of the other. Anthropic sources of copper in the environment are the use of certain agricultural products and industrial activity connected with the production of metal.

Monitoring by Pontenossa has found fairly even levels of copper in leaves (average of 9.16 mg/kg), with higher concentrations in southern and north western areas. As far as soil is concerned, average levels equal to 37 mg/kg have been measured (a value commonly found in Italy even in farming soil), with concentrations up to twice as high as the average recorded downstream of the Riso torrent and river Serio.

The D. Lgs. 99/92 and Directive 86/278/EEC both set maximum concentration limits equal to 100 mg of copper/kg s.s. and 140 mg of copper/kg s.s. destined for re-use on waste soil.

Ministerial Decree for the Environment D.M. 471/99 regarding contaminated sites sets different values on the copper content in the soil depending on whether it is used for green and residential areas or for commercial and industrial purposes. Suggested values (both as limits for contaminated soil and drainage purposes) are 120 mg/kg s.s. for soil used in green and residential areas and 600 mg/kg s.s. for commercial and industrial purposes.

Zinc. Absorption of this metal by plants varies from one species to another and is in proportion to concentrations in the ground. Zinc has an essential biological role in both plants and animals where it plays a part in the structure of enzymes that have an important metabolic function. Common anthropic sources of zinc are the non-ferrus metals industry and farming practices.

Around the Pontenossa plant, average concentrations of zinc in the soil are about 690 mg/kg.

The D. Lgs. 99/92 and Directive 86/278/EEC have set maximum concentration limits of zinc in the soil equal to 300 mg/kg s.s. Ministerial Decree for the Environment D.M. 471/99 regarding contaminated sites set different values of zinc content in the soil if it is used in green and residential areas or for commercial and industrial purposes. Suggested values (both as limits for contaminated soil and drainage purposes) are150 mg of zinc/kg s.s. for soil used in green and residential areas and 1500 mg of zinc/kg s.s. for commercial and industrial purposes.

Average values found in leaf matrices are about 480 mg of zinc/kg, with an excess amount recorded downstream of the Riso torrent near the plant's service car park. These values are higher when compared to the normal contents of zinc in food (e.g. beans 36.5 mg/kg, spinach 7.6 mg/kg) but far lower than doses that could be toxic for humans.

In short, (Ref. 59), leaf and soil samples taken in different areas to the Riso Valley show abnormal levels of certain metals (zinc and lead, in particular). This actually reflects the geo-chemical abnormalities of the territory linked to the presence of lead and zinc reserves and anthropic abnormalities related to past mining activities and to the the activities of the metallurgic industry. Results give a fair idea of impact over a long period of time (decades), from the time industrial activity first began in this part of the Seriana Valley. As far as the leaves are concerned, data doesn't indicate trends that are generally compatible with the hypothesis of an anthropic origin of metals found in the samples, with the exception of those collected near the plant's external service car park which is situated along a fairly busy road.

The concentration values of metals measured in the soil and in leaves are not strictly correlated with one another save a few exceptions. Similarly, data from leaf samples are not measurable in terms of confirmed correlations certe (Ref. 59).

The study under examination here shows some limitations. Analytical measurements wre carried out only once, in a single season on a small number of samples and without using terms of comparison outside the observed area.
However, the collected data enables preliminary assessment and, above all, it represents an important basis to start from in order to introduce a systematic program of bio-monitoring which is necessary in the field of prevention.

6.5. Noise

Since the DPCM 01.03.1991 was introduced, Pontenossa has been recording noise levels generated by their own industrial activity
Phonometric measurements carried out in april 1999 have not gone over the limit of 70 dBA, except in the area directly around the plant's perimeter along the main road SP 46 (a non residential area) where values around 70 dBA have been recorded from the passing traffic.

Measurements taken in September 2001 found that noise levels were above the accepted standards and consequently Pontenossa began plans to improve these acoustic levels by means of interventions to the end part of the Waelz ventilator, the axial ventilators of the organ piped cooler and the end ventilator of line 3 production of fine oxides (no longer in use today).

In 2004, between 27 July and 4 August, the Company carried out noise monitoring campaigns with the help of eleven different receptors (three inside and the rest outside) and results showed that noise produced from the plant nearest to built up areas along the main road SP 46 is about 3 dBA, from readings recorded of noise generated by traffic and the Riso torrent.

The following assessment of noise impact carried out in 2008 confirmed the compatibility of the industrial settlement with area limits in force and excluded any need for mitigation. (Ref. 6).

The plant does not have any significant impact on the acoustic climate of the area. Current levels of noise are compatible with existing zones. In the area around the plant, low to average residual noise can be registered (Lr values between 45 **4** and 50 dBA), considering that the Riso torrent generates varying noise levels ranging between 55 and 60 dBA.
General opinion is that growth in activity will not determine great variations in duration and intensity of noise emission (Ref. 24). Increase in amounts of gas to the chimney is obtain by opening the control shutter which should infact, reduce aerodynamic noise.
Heavy traffic could increase by six heavy vehicles per day (from 35 to 41) which can be considered a negligible impact.

Calculations carried out using a three-dimensional acoustic model exclude any variations connected to the enlargement of the disposal site (Ref. 24).

Regulations included in the AIA Regional Decree 2010 (Ref. 16) require the Company to carry out further acoustic recording programs every three years. The monitoring program conducted in October 2011 confirmed the same acoustic impact assessment results as those obtained in 2008.

6.6. Induced traffic

Among potential factors of pollution, we have to consider heavy vehicles that carry raw materials and waste for disposal. In urban areas traffic is the primary cause of air quality deterioration. Road transport accounts for a quantity of NOx thought to be over 30% of the total. It is likely that PM10 from heavy vehicles accounts for 14% PM10 measured in the atmosphere compared to 6% from Energy production plants and fuel transformation and 13% for non industrial combustion processes. In theory, induced heavy traffic pollution could have a negative impact quite separate from any specific activity from Pontenossa site. Calculated values are difficult to obtain especially when the origin of material delivered to the plant either vary or are unknown.
Induced heavy traffic has been a subject for study on location. Research carried out by Milan Polytechnic (Ref. 53) shows that transport and movement of material into and out of the plant could give rise to widespread emission of dust along the roads travelled by these vehicles and in the plant area itself. Values relative to the increase of traffic are limited. Most of the manufactured products come from areas that are not so distant from the plant (Brescia). Routes travelled by trucks carrying material are therefore reduced. The vicinity to the main suppliers helps optimize logistics thus reducing the distance that dust has to travel and minimizes related risks.

The management system for disposal, transports Waelz slags in quantities equal to 50.000 m^3/year, which corrispond to about 20 journeys per day (Ref. 16).

The planned enlargement of the disposal site, authorized by VIA Regional Decree n. 7023 of 08/07/2009, does not increase the daily volume of transport very much.

7. IMPACT ON HEALTH

Analysis of health impact (public health and health of workers) has been examined here taking into account the following aspects: (i) *Damage efficiency and intrinsic risks* of chemical pollutants used in the production processes of Pontenossa. These parameters are deducible from toxicological, epidemiological and clinical knowledge from scientific literature.; (ii) *Duration of exposure:* this has been established on the basis of measurements taken from the environments involved (general environment, working environment), checking if levels of exposure to risk in the plant corrispond in terms of intensity and duration to produce harmful effects; (iii) *State of health of the populace* (residents living near the Pontenossa plant and plant workers): this is deducible from available epidemiological and clinical information.

Assessment is based exclusively on practical data. Therefore, in this case, inevitable limits are encountered due to a lack of specific epidemiological and biostatistical data of the area concerned, which are necessary to define the causal relationship between pollution and health in terms of extension, risk, frequency, duration and persistence of the effects (Ref. 37-38). The risk factor takes into account the following uncertainties.

7.1. Impact in public health

Assessment is mainly concerned with pollutants found in emissions from the plant, particularly those in the atmosphere. Here we find typical atmospheric pollutants whose harmful effects on man are well-known (Table n 20). These substances can cause acute or cronic toxic effects. The first type emerges from time to time with especially high peaks of pollution (e.g. Incease of fine dust and NOx in wintertime and increase of ozone in the hotter months). Cronic effects (cronic pneumonia, coughing with cattar, reduction of lung capacity, etc.) develop progressively in time (years or decades) in susceptible subjects.

Table n. 20. Pollutants in the environment discussed in this White Paper. Effects on human health and the environment (Ref. 91).

Nitrogen oxide (NOx).
Found in Energy production plant emissions and in numerous other industrial sites. It contrubtes to acidifying and eutrophicating water and soil. It enables the formation of fine dust and helps generate ozone. Toxic effects mainly target the respiratory ducts. NO_2 has notably irritating effects and in high concentrations can cause inflammation of the respiatory ducts and lung deterioraton. Pollution from NO_2 increases the incidence of cardiorespiratory illnesses in adults and accentuates susceptibility of pneumatic infections in children. In many EU states the limits of NOx emissions have been well surpassed despite the introduction of measures taken to contain them. The main cause is road transport which accounts for 14% of emissions in Europe (Ref. 99).

Sulphurous acid (SO_2)
Generated from use of fuels containing sulphur (non methane heating systems, thermo electric power stations, industrial plants, motor vehicles). Like NOx, it has acidifying effects enabling the formation of fine dust. It is the main cause of acid rain as it tends to transform into SO_3 and in humid conditions, into sulphuric acid. It has significant effect on the ecosystems of rivers and lakes and causes damage to forests. High concentrations of SO_2 in humans causes adverse effects on the lungs and irritation to the respiratory ducts.

Ammonia (NH_3)
Responsible for acidification and eutrophication to environmental processes. In Europe, most NH_3 emissions (94%) come from agriculture. High concentrations of NH_3 provoke irritation (skin, conjunctivitis, respiratory ducts).

Flying organic compounds (FOC)
These are released into the atmosphere through numerous types of emmision from industrial plants; they can be found in motor vehicle emissions and in a vast range of chemical and consumer products. They impact the environment like ozone precursors. Some FOCs (benzene, 1,3-butadiene) are highly toxic and cancerogenous.

Fine dust (PM10, PM2.5)
Particulate is a mixture of solid and liquid particles that can remain suspended in the air for long periods of time. They contain a complex group of elements particularly carbon, lead, nickel, nitrates, sulphates,organic compounds, soil fragments, etc. they can be found in the atmosphere as primary dust (a fraction is emitted directly from polluted springs) or secondary dust (a fraction that is formed in the atmosphere by gas precursors (SO2, NOx, etc.) and by FOC.
Dust makes up the most important class of atmospheric pollutants as far as impact on health is concerned. It is inhaled and penetrates into the respiratory apparatus causing or aggravating cardiovascular and respiratory pathologies. The people most at risk are the elderly and those with cronic cardio respiratory pathologies. Cronic exposure leads to an increate risk of lung tumors.
Particulate can be identified in three classes with different penetration capacity into the respiratory ducts (properties, as mentioned before, determined by the nature and intensity of their harmful effects: (i) PM10 – particulate formed by particles with a diameter of < 10 μm: inhalable dust which can penetrate the upper respiratory ducts (nose, pharynx and larynx); (ii) PM2.5, fine particulate with a diameter of < 2,5 μm, capable of penetrating into the tracheobronchial aparatus (trachea, bronchial tubes, bronchioles); (iii) PM0.1 – ultra fine particulate (dwarf particles) with a diameter of < 0,1 μm, capable of penetrating deeply into the lungs as far as the alveoli. Various types of toxic pollutants (metals, polycyclic hydrocarbons, odours, etc.) are absorbed and incorporated into the atmospheric particulate which becomes a vehicle that aids the absorption of these harmful species into the organism.

Heavy metals
Emissions of heavy metal comes mainly from fuel combustion processes both industrial and non industrial and from production processes especially in the energy sector.
Heavy metals are considerably toxic as they persist in the environment and once absorbed, produce alterations to organs and tissues. These include neurotoxic agents e.g. lead which can slow down the neuro-behavioural development in children if absorbed in excessive doses. Other metals like arsnic, cadmium, chrome and nickel are classified as cancerongenous. Apart from polluting the atmosphere, certain metals of industrial origin (cadmium, mercury, lead) are transferred to the soil in sediment and superficial waters and tend to accumulate in the food chain.

Organic micro pollutants
Benzene, polycyclic hydrocarbons, odours (IPA), dioxins and furans. Emission of these substances comes from complex mixtures and originates from plants that use fossil fuels to produce energy, from burning waste and other specific industrial processes. Dioxins, furans and IPA tend to bio accumulate in the environment. They cause important toxic effects and some of them are cancerogenous for humans.

Carbon dioxide (CO_2)
CO_2 is released into the environment by energy producing plants, by combustion processes of natural gas and biomass, from domestic heating systems and emissions from motor vehicles. It is the main green house gas that is believed to have an important impact on climate change.

7.1.1.Atmospheric pollution and human health. Epidemiological effects. I Toxicological data finds a response in epidemiology. Certain studies show that industrial activity linked to the production or use of metal material can determine pollution from dust, gas, and metals (zinc, cadmium, iron, lead etc.) with consequent problems to human health (Ref. 106, Ref. 115-116).

Table n. 21.Effects of atmospheric pollution. Increase in death rate (Ref. 84).

Parameter and studied population		
Health results	Pollutants (units of measurement)	Measurements (confidence interval 95%)
Short term effects		
Study: Ostro et al, 2007: Over 22 million adults, 9 American cities		
Daily death rate:	$PM_{2,5}$ ($\mu g/m^3$)	% increase per increase of 10 μg/m3 of $PM_{2,5}$
total		0,61 (0,18-1,04)
respiratory		2,05 (0,02-4,12)
cardiovascular		0,70 (0,07-1,33)
Study: Gryparis et al, 2004: Over 50 million adults, 23 European cities (APHEA 2)		
: Daily death rate	O_3 ($\mu g/m^3$)	% increase per increase of 10 μg/m3 of $PM_{2,5}$
total		0,31 (0,17-0,52)
respiratory		1,13 (0,74-1,51)
cardiovascular		0,46 (0,22-0,73)
Study: Biggeri et al, 2004: 9,1 million adults, 15 Italian cities (MISA)		
Daily death rate:		% increase per increase of 10 $\mu g/m^3$ of NO_2, and PM_{10} and of 1mg/m^3 of CO:
All causes	NO_2 ($\mu g/m^3$	0,6 (0,3-0,9)
	PM_{10} ($\mu g/m^3$)	0,31 (0,2-0,7)
	CO (mg/m^3)	1,2 (0,6-1,7)

Long term effects

Studiy: Pope et al, 2002: 500.000 adults, United States

Death rate:	$PM_{2,5}$ ($\mu g/m^3$)	Relative risk for increase of 10 µg/m3 di $PM_{2,5}$
All causes		1,06 (1,02-1,11)
cardio-polmonary		1,09 (1,03-1,16)
Lung tumor		1,14 (1,04-1,23)

Indicators that are witness to the health impact of pollution are hospitals, daily check ups in casualty units, numerous check ups by general practitioners, pharmaceutical consumption, worsening symptoms of patients with respiratory or cardiocirculatory pathologies in casualty units (Ref. 9, 30, 96, 97). A general picture is given by studies that have examined the increase of the death rate in the population (Table n. 21) and indices of hospital admission and the prevalence of acute and cronic respiratory illnesses (Tables n. 22 e n. 23).

Convincing evidence also comes from epidemiological studies that examine singular pollutants. For example, in calculating an increase of 10 $\mu g/m^3$ in the atmospheric concentration of PM10, there is a definite corrisponding deterioration in health impact, expessed in terms of death rate, hospital admissions, consumption of medicines and sick leave from work etc. (Table n. 24).

The World Health Organization (WHO) estimates that pollution from fine dust accounts for l'1,4% of death rate in the popolation (Ref. 43). With every increase of 10 $\mu g/m^3$ of PM10 the death rate for all causes would grow by 0,6%, the rate of hospital admission for asthma and cronic bronchitis 1% and by nearly 0,5% the number of hospital admissions for cardiovascular pathologies (Ref. 19).

Table n. 22. Effects of atmospheric pollution. Indices of hospital admissions and prevalence of respiratory illnesses (Ref. 84).

Parameter and studied population		
Health outcome	Pollutants (units of measure)	Measurements (IC 95%)
Short term effects		
Study: Anderson et al, 1997: over 18 million adults, 6 european cities (APHEA)		
		Relative risk for an increase of 50 μg/m^3 of pollutants
Hospital admission for bronchial problems Cronic obstructive pneumopathy	BS* (μg/m^3) PTS (μg/m^3) NO_2 (μg/m^3) O_3(μg/m^3) SO_2,(μg/m^3)	1,04 (1,01-1,06) 1,02 (1,00-1,05) 1,02 (1,00-1,05) 1,04 (1,0-1,07) 1,02 (0,98-1,06)
Study: Biggeri et al, 2004: 9,1 million adults, 15 Italian cities (MISA)		
		% increase for an incease of 10 μg/m^3 di NO_2, e PM_{10} and of 1 mg/m^3 di CO
Hospital admission due to respiratory causes	NO_2 (μg/m^3) CO (mg/m^3) PM_{10} (μg/m^3)	0,77 (0,08-1,50) 1,25 (0,19-2,25 0,60 (0,22-1,05)
Hospital admission for cardiac causes	NO_2 (μg/m^3) CO (mg/m^3) PM_{10} (μg/m^3)	0,57 (0,25-0,91) 1,44 (0,75-2,14) 0,29 (0,04-1,50)
Study: Dominici et al, 2006: over 200.000 adults, 204 Americane cities		
		% increase per increase of 10 μg/m^3 di $PM_{2,5}$
Hospital admission for BPCO	$PM_{2,5}$ (μg/m^3)	0,90 (0,18-1,64)
Hospital admission for cardiac decompensation		1,28 (0,78-1,78)
Hospital admission for ischaemic heart diseases		0,44 (0,02-0,86)
Study: Medina-Ramoni et al, 2006: over 578.000 admission, 36 american cities		
		% increase per increase of 10 μg/m^3 di PM_{10}
Hospital admission for BPCO	PM_{10} (μg/m^3)	0,81 (0,22-1,41)
Pneumonia		0,84 (0,50-1,19)
Long term effects		
Study: Schikowski et al, 2005: 4.757.000 women (aged 50-59), Germany		
		Odds Ratio (OR) per increase of a range of pollutants: (16 μg/m^3 di NO_2; 7 μg/m^3 di PM_{10})
BPCO	NO_2 (μg/m^3) $PM_{2,5}$ (μg/m^3)	1,43 (1,23-1,66) 1,33 (1,03-1,72)
Study: Annesi-Maesano et al, 2007: 5.338.000 children in French cities		
		Odds Ratio (OR) per concentrations of $PM_{2,5}$ > 10 μg/m^3
Asthma Atopical asthma	$PM_{2,5}$ (μg/m^3)	1,31 (1,04-1,66) 1,58 (1,17-2,14)
Study: Brauer et al, 2007: 4.146 children (aged 0-4), Holland		
		Odds Ratio (OR) per increase of a range of pollutants: (10,6 μg/m^3 di NO^2; 3,3 μg/m^3 di PM_{10})

Wheezing Asthma	NO_2 ($\mu g/m^3$) $PM_{2,5}$ ($\mu g/m^3$)	1,19 (1,05-1,34) 1,22 (1,06-1,41)
	NO_2 ($\mu g/m^3$) $PM_{2,5}$ ($\mu g/m^3$)	1,28 (1,04-1,56) 1,54 (1,04-1,69)

Table n. 23. Effects on health from atmospheric pollution. Long term effects (Ref. 84).

Parameter and studied population		
Effects on health	Proxy exposure	Measurements (IC 95%)
Long term effects		
Study: Gehring et al, 2006: 4.757.000 women (aged 50-59), Germany		
Death rate cardio-polmonary	Living in housing within a range of 50m from very busy roads	Odds Ratio (OR) 1,70 (1,02-2,81)
Study: Beelen et al, 2008: 120.852 adults Holland		
Death by cause: natural cardiovascular respiratory lung tumors	Living near busy roads	Relative risk 1,05 (0,97-1,12) 1,05 (0,93-1,18) 1,19 (0,91-1,56) 1,20 (0,98-1,47)
Study: Schikowski et al, 2005: 4.757.000 women (aged 50-59), Germany		
Cronic obstructive broncopneumopathy	Living within 100 m of busy roads	Odds Ratio (OR) 1,79 (1,06-3,02)
Study: Iversen et al, 2005: 44.560 adults, Scotland		
	Rural living compared to urban living	Odds Ratio (OR)
Asthma		0,59 (0,46-0,76)
Coughing and cronic bronchitis		0,76 (0,61-0,94)
Dispnea		0,66 (0,48-0,90)
Wheezing		0,76 (0,61-0,94)
Wheezing attacks		0,70 (1,55-0,88)
Heart disorders		1,74 (0,55-1,00)
Study: Ciccone et al, 1998: about 39.000 children (aged 6-7; aged 13-14), Italy		
	Continuous movement of trucks near residential area	Odds Ratio (OR)
Bronchitis		1,69 (1,14-2,30)
Bronchiolitis		1,74 (1,09-2,77)
Pneumonia		1,84 (1,27-2,65)
Persistant coughing		1,68 (1,14-2,48)
Heavy wheezing		1,86 (1,26-2,73)

It is therefore evident that pollution also leads to an economic burden as regards the costs of managing diseases and all that is connected with them (hospital admissions, pharmaceutical expenses, etc.). According to the European Agency for the Environment, the consequences of pollution on health and environment produced by the 10.000 biggest industrial plants add up to economic costs between 102 and 169 billion Euros (calculations taken in 2009).

It is worth noting that half of these costs (between 51 and 85 billion Euros) is due to the impact of only 191 industrial sites. Atmospheric pollution costs each European citizen between 200 and 300 Euros (Ref. 99). This type of data should be considered an important part of political and environmental issues including those regarding prevention.

Table n. 24. Impact on health of pollution from PM10.

Increase of daily death rate	
by respiratory causes	**3-4%**
by cardiocirculatory causes	**1-2%**
Increase in hospital admissions	
for respiratory diseases	**1.5-2%**
for cardiocirculatory diseases	**0.5-1%**
Increase in consumption of pharmaceutical products	**5%**
Increase in sick leave from work, reduction of activity due to illness	**10%**

Increase in the fequency of acute events linked to the increase of 10 µg/m^3 in atmospheric concentrations of PM10. By F. Forastiere (Ref. 34).

From the latest data it would seem that fraction PM2.5 of the partichlorate has an important role in pathologies from environmental causes. According to the World Health Organization (WHO), the concentration of PM2.5 shouldn't go over 10 µg/m^3, as a yearly average, compared to a far higher value (25 µg/m^3) established by the European Union as an objective to reach by 2015.

Even today there remains a shortage of information about the impact of much smaller particles with an aerodynamic diameter of < 2.5 micron. It is probable, however, that the latter has a considerably harmful effect a sit can easily penetrate the respiratory aparatus and tends to incorporate other types of toxic pollutants such as metals and aromatic polycyclic hydrocarbons (Ref. 5, 11, 12).

As we can see, limits established by the EU for PM10 are 40 µg/m^3 (yearly average) and 50 µg/m^3 (daily average), with a maximum of 35 exceeded limits per year. Using the same indicator, WHO suggests lower levels (respectively 20 µg/m^3 and 50 µg/m^3 as a yearly average and an average within 24 hours (Table n. 25).

Table n. 25. Values not to be surpassed according to the World Health Organization.

	Period of data collection	Limit (µg/m^3)
PM2.5	Yearly average	10
	Average in 24 hours	25
PM10	Yearly average	20
	Average in 24 hours	50
Nitrogen oxide (NO2)	Yearly average	40
	Average in 1 hour	200
Sulphurous acid (SO2)	Average in 24 hours	20
	Average in 10 minuti	500
Ozone	Average in 8 ore	100

Directive 2004/107/EC of the EU establishes an objective value to the maximum atmospheric concentration of other pollutants (arsenic, cadmium, nickel and benzo(a)pirene) as part of a strategy to prevent harmful effects on health (Ref. 104).

As we can see, the health impact of atmospheric pollution is calculated by taking into account the environmental levels of single substances considered a health risk, as an exposure index, with the reference point being the official value limits established for the same pollutants. In certain cases calculations are not made only in absolute terms, i.e. as a gap between measured values and values set according to law, but also in relationship to the number of times limits have been surpassed in a certain length of time.

To get a deeper under standing of the subject, it would be useful to examine the significance of value limits from a medical and biological point of view.

Value limits are maximum concentrations of a pollutant to which an average person can be exposed and incur small chances of negative repercussions on the health (Ref. 10). Value limits are *indices of protection* which are applied using large safety margins in order to protect even the most susceptible people. Respecting value limits doesn't ensure absolute protection. In certain situations, a particularly sensitive person can be affected by a toxic pollutant even when exposed to doses well tolerated by the rest of the population and also when the levels of exposure are equal to or inferior to the value limit (Ref. 9, 40-42, 96, 97). For example, for certain types of pathologies (asthma, allergies, self-immunitory illnesses, etc.), it is still impossible to identify the minimum concentration of pollutant (e.g. PM10, PM2.5) under which the risk of exposure is equal to zero (Ref. 11, 45-47).

Epidemiological and clinical studies offer many examples of people who are hyper-sensitive to environmental diseases. Respiratory deterioration in certain patients has been diagnosed after cronic exposure to PM10 levels, between 10 and 33 µg/m^3, well below limits established by law of 50 µg/m^3 (Ref. 36). Keeping this in mind, the World Health Organization has not fixed a definite limit for PM10, and has suggested a standard limit based on the relationship between dose and response from which *relative risk* can be established for increases of 10 µg/m^3 di PM10 (Rif. 10). These outlines offer an important preventive basis but it would be difficult to apply it today as standard regulations for air quality.

The existence of so many risk factors is another subject to consider when examining health assessments with reference to value limits. For example, in the case of PM2.5, adverse effects have been recorded even with concentrations below 20 $\mu g/m^3$ where other factors have been involved (smoking habits, patients with cardiac or respiratory pathologies, etc.) which increase individual sensitivity to the effects of pollution (Ref. 92). The matter is of practical relevance and there are considerable recurrences in the risk assessment process. Environmental pollutants are generally absorbed in combination with others in the form of complex mixtures (Ref. 13). Interactions between the compounds in mixtures can highten the toxic response and consequently determine risk situations that are different from those where only the single substance has been measured (Ref. 14, Ref. 49). We should keep in mind that atmospheric pollution tends to propagate. Production sites in close proximity to eachother become a single complex of emissions including also road traffic and heating systems. In these scenarios, impact on public health should be calculated in terms of accumulative phenomena.

In short, respect for standards that establish maximum levels of emissions and environmental concentrations of harmful chemical specimens, is an essential instrument in terms of prevention. However, the "value limit" shouldn't be considered a boundery between a healthy environment and a harmful one, much less as a clear margin beyond which we can expect the disappearance of damaging effects to the health. A value limit is a scientific reference parameter used to prevent risks and to intervene quickly if necessary, with measures that safeguard public health.

Exposure limits are generally considered to be universal. In fact many factors can weaken the link between environmental doses and the toxic and clinical effects of pollutants (Ref. 50). We have just mentioned the problem of pollutant combinations. There is still a lack of criteria and methods of recognised scientific value to establish sicure limits for exposure to polluting substances that are absorbed in mixtures (Ref. 13, 14).

Relationships between pollution and human pathologies have to be closely evacuate and examined case by case to esablish any possible variations capable of modifying or hindering causality.

7.1.2. Local health indicators. In this section two aspects are examined:

(i) Demographic and biostatistical indicators regarding the state of health of the local population;

(ii) Local factors, unrelated to the activities of the Pontenossa site, that could have an impact when acting on the same anthropic receptors as added or accumulative risks.

Demographic picture. Five towns, either completely or partially, are located in the area of the Pontenossa site (Ponte Nossa, Gorno, Premolo, Oneta and Parre), with a total surface area of 74,49 km^2 and a total population (data 2010) of 8.249 inhabitants (Table n. 25).
The average living density of the five towns (148,18 inhabitants/km^2) is lower than the whole Upper Seriana Valley (503,7 inhabitants/km^2) and Province of Bergamo (389,2 inhabitants/km^2) (Data from ISTAT 2008).

In the five towns in question, demographic data does not highlight anomalous situations regarding average age, birth rate, death rate, population distribution per age group, aging index (Table n. 26). Death rates recorded in 2010 show 10.9/1000 inhabitants in Ponte Nossa, 15.4/1000 inhabitants (Gorno), 13.8/1000 inhabitants (Premolo), 10.6/1000 inhabitants (Oneta) and 10.9/1000 inhabitants (Parre) –an average of 12.32 – completely in accordance with data recorded in an urban situation relative to the provincial capital and the entire Province of Bergamo.

Table n. 26. Demographic details of towns in the area where Pontenossa S.p.A. is located. For comparative purposes data relating to the city of Bergamo have been included.

	PONTE NOSSA	**GORNO**	**PREMOLO**	**ONETA**	**PARRE**	**BERGAMO**
Resident population (in 2010)	*1.923 inhabitants*	*1.684 inhabitants*	*1.166 inhabitants*	*661 inhabitants*	*2.815 inhabitants*	*119.234*
males	*919*	*844*	*597*	*331*	*1.404*	*56.391*
females	*1.004*	*840*	*569*	*330*	*1.411*	*64.303*
Surface area, *km²*	*5,57*	*9,87*	*18,31*	*18,26*	*22,48*	*5,57*
Density Inhabitants per km²	*345,2*	*170,6*	*63,7*	*36,2*	*125,2*	*345,2*
Number of families (in 2010)	*898*	*772*	*518*	*301*	*1.146*	*451.970*
Average age (in 2011)	*47,2*	*44,9*	*43,3*	*46,5*	*40,8*	*45,0*
Average income in Euros (in 2010)	*12.312*	*11.287*	*13.074*	*11.735*	*11.413*	*18.315*
Population trend (2001-2010)	*Reduced by 5,7%*	*Reduced by 5%*	*Increased by 13,4%*	*Reduced by 7%*	*Increased by 4,4%*	*Increased by 5,7%*
Birth rate (in 2010)	*6,2% for 1.000 inhabitants*	*7,7% for 1.000 inhabitants*	*7,8% for 1.000 inhabitants*	*1,5% for 1.000 inhabitants*	*9,5% for 1.000 inhabitants*	*8,4 for 1.000 inhabitants (in 2011)*
Death rate (in 2010)	*11,9% for 1.000 inhabitants*	*15,4% for 1.000 inhabitants*	*13,8% for 1.000 inhabitants*	*10,6% for 1.000 inhabitants*	*10,9% for 1.000 inhabitants*	*10,9% for 1.000 inhabitants*
Population by age group (in 2011)	*11,4% aged between 0-14* *60,5% between 15-64* *28,0% over 65*	*11,3% aged 0-14* *67,1% aged 15-64* *21,6% over 65*	*14,3% aged 0-14* *65,5% aged 15-64* *20,2% over 65*	*10,7% aged 0-14* *65,4% aged 15-64* *23,9% over 65*	*15,8% aged 0-14* *67,4% aged 15-64* *16,8% over 65*	*13,34% aged 0-14* *63,1% aged 15-64* *23,6% over 65*
Old age index (in 2011)	*245,0%*	*191,6%*	*140,7%*	*222,5%*	*106,1%*	*177,9%*
Cars (in 2009)	*552 cars every 1.000 inhabitants*	*600 cars every 1.000 inhabitants*	*532 cars every 1.000 inhabitants*	*595 cars every 1.000 inhabitants*	*553 cars every 1.000 inhabitants*	*596 cars every 1.000 inhabitants*

In the Upper Seriana Valley, similar demographic data can be found that compares with the entire province of Bergamo where the number of young people in the population and that of those of an employable age has gone down while there has been an increase in the elderly population.

The index of demographic aging (ca. 19) is higher than the average in the province (IID 17.75), as the ageing index seen in Figura n. 21. Other demographic indices such as birth rate (9.23), dependency index (51.47) index of family members (20.41) differ negatively from the average of the province proving that we are facing an ever ageing population.

From a survey conducted by means of a series of interviews, 85% of elderly people claimed to be in satisfactory health conditions and in the family environment three thirds claimed to be active in helping and supporting their children and grandchildren, while 51% were involved in voluntary work compared to national statistics of 20% (Ref. 22, ASL Bergamo, AT Valle Seriana Superiore and Val di Scalve, PdZ 2012-2014, web site, updated to 12 april 2012).

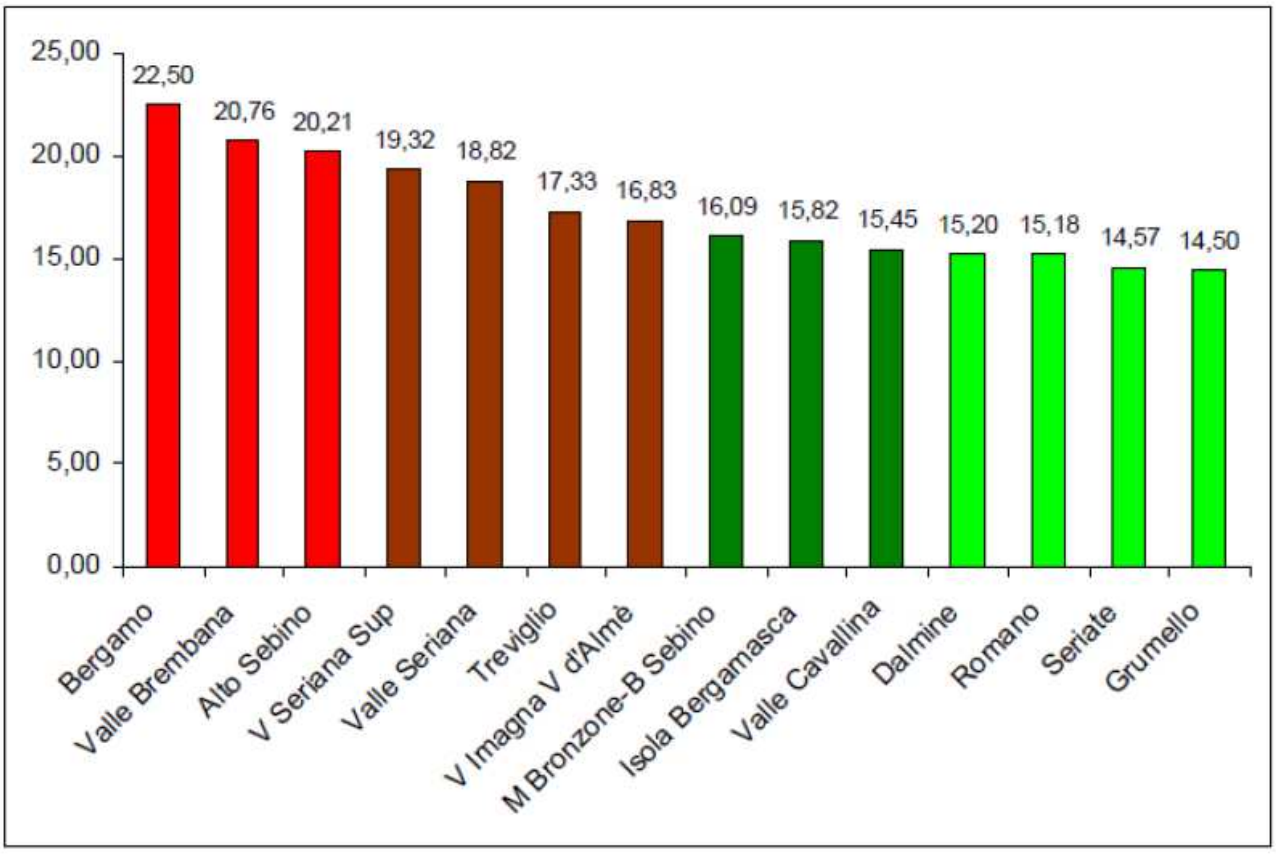


Figure n. 21. Ageing index recorded in health office zones of the ASL in the province of Bergamo (Ref. 22)

According to data from ISTAT 2008, the percentage of over 80s living in the Upper Seriana Vally (Valle Seriana Superiore) is equal to 4.9%, compared to 4,27% in the province of Bergamo and 5.0% in Lombardy (Ref. 22).

Health index. The Pontenossa plant is located in an area where there is an active program of surveillance of public health which give up to date information on the state of health of the local population.

Local health indicators do not show any critical or unusual conditions and highlight a coherent picture that compares with that of other urban areas in the province and in the region of Lombardy.

Data that has been discussed here was taken from the document “Epidemiology of Tumors: Distretto Socio-Sanitario Valle Seriana” (Seriana Valley Health Office) researched by the Health Office of Bergamo (Direzione Distrettuale ASL di Bergamo (Ref. 22) the period between 1999-2006.

Table n. 27. Standard report on di mortality by neoplastic diseases in the districts of the Province of Bergamo. (Ref.22).

Males

Distretto	smr	LI_smr	LS_smr
D01-Bergamo	0,90	0,87	0,94
D02-Dalmine	1,05	1,01	1,05
D03-Seriate	1,01	0,95	1,08
D04-Grumello	1,05	0,97	1,13
D05-Valle Cavallina	0,94	0,87	1,01
D06-Monte Bronzone-Basso Sebino	1,12	1,02	1,22
D07-Alto Sebino	1,01	0,93	1,10
D08-Valle Seriana	1,00	0,95	1,05
D09-Valle Seriana Superiore e Valle di Scalv	1,08	1,01	1,15
D10-Valle Brembana	0,99	0,93	1,06
D11-Valle Imagna e Villa d'Almè	0,89	0,83	0,96
D12-Isola Bergamasca	1,07	1,02	1,12
D13-Treviglio	0,97	0,93	1,02
D14-Romano di Lombardia	1,08	1,02	1,14

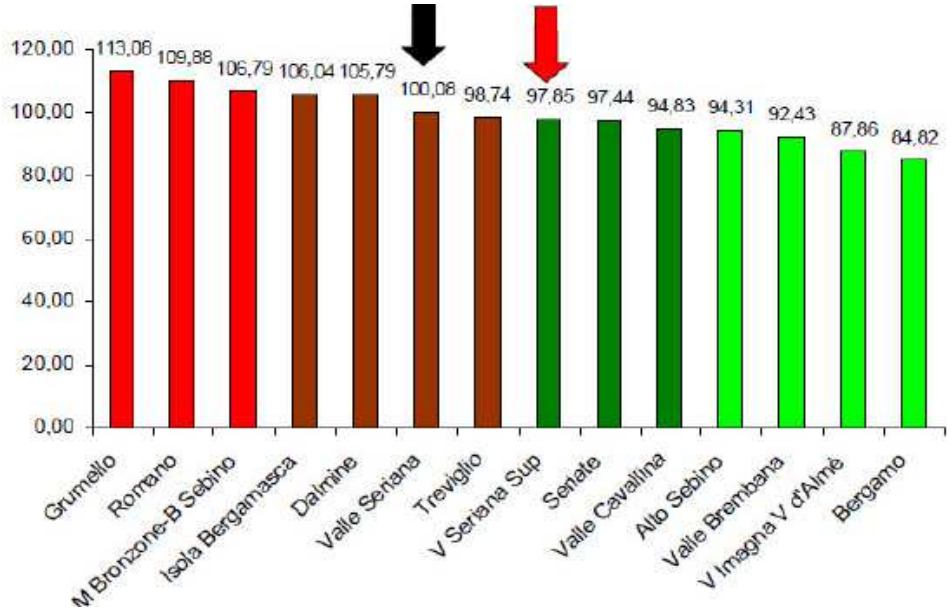
Females

Distretto	smr	LI_smr	LS_smr
D01-Bergamo	1,04	1,00	1,08
D02-Dalmine	1,06	1,00	1,06
D03-Seriate	0,99	0,92	1,07
D04-Grumello	0,93	0,84	1,02
D05-Valle Cavallina	1,02	0,93	1,10
D06-Monte Bronzone-Basso Sebino	1,03	0,92	1,14
D07-Alto Sebino	0,83	0,75	0,92
D08-Valle Seriana	1,09	1,03	1,15
D09-Valle Seriana Superiore e Valle di Scalv	1,06	0,98	1,14
D10-Valle Brembana	0,93	0,86	1,01
D11-Valle Imagna e Villa d'Almè	0,87	0,80	0,95
D12-Isola Bergamasca	0,96	0,91	1,01
D13-Treviglio	0,97	0,92	1,03
D14-Romano di Lombardia	0,99	0,93	1,06

Standard rate of yearly mortality through tumors recorded in Seriana Valley are in line with values recorded in other districts of the provincial territory. (Table n. 27).

Figure n. 22 shows the death rates for lung tumors. In the districts concerned there are no abmormal ricurrences compared to the relative picture in other provincial areas.

MALES



FEMALES

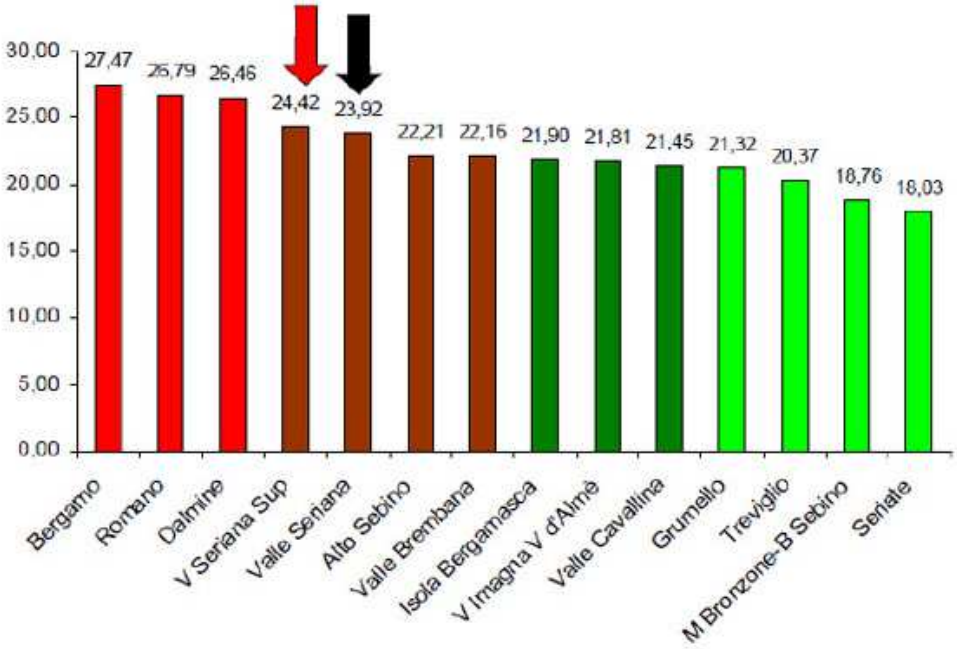


Figure n. 22. Epidemiology of Lung Tumors (1999-2006). Standared yearly rates of mortality (x 100.000) per district health service (ASL Bergamo, Ref. 22)

These indicators are confirmed also when considering the incidence rates for neoplasia in the province of Bergamo, North Italy and the city of Milan (Table n. 28).

Table n. 28. Incidence rates for tumors: Province of Bergamo, North Italy and Milan.

(a) Males

Tumor pathology	**Code ICD-10**	**Number of cases**			**Rough annual rate (x 10^{-5})**	**Standard annual rate (x 10^{-5})**		
		2002	**2003**	**2004**	***Bergamo Province***	***Province Bergamo***	***North Italy***	***Milan***
Malign stomach	C16	220	199	198	42,2	37,1	24,9	20,8
Malign bowel	C18	243	229	230	48,1	42,1	46,4	44,3
Malign rectum	C19-21	122	116	137	25,7	23,0	20,2	18,3
Malign liver	C22	279	231	241	51,4	44,5	23,6	22,2
Malign pancreas	C25	94	98	92	19,4	17,2	13,7	13,1
Malign lung	C33-34	516	518	532	107,2	93,4	81,8	86,6
Malign prostate	C61	546	568	605	117,7	100,6	102,1	85,7
Non Hodgkin linphoma	C82-85,96	92	79	106	19,0	17,1	19,3	20,4
Leuchemia	C92-95	74	76	87	16,2	15,2	12,8	14,6

(b) Females

Tumor pathology	**Code ICD-10**	**Number of cases**			**Rough annual rate (x 10^{-5})**	**Standard annual rate (x 10^{-5})**		
		2002	**2003**	**2004**	***Bergamo Province***	***Bergamo Province***	***North Italy***	***Milano***
Malign stomach	C16	153	156	153	30,7	19,2	12,1	11,9
Maligni bowel	C18	194	203	216	40,8	26,3	30,7	30,4
Maligni rectum	C19-21	77	85	94	17,0	11,6	10,4	11,2
Malign liver	C22	137	114	106	23,7	14,4	5,8	6,2
Malign pancreas	C25	110	89	98	20,0	12,6	10,2	9,8
Malign lung	C33-34	128	158	141	28,4	19,4	19,5	24,5
Malign breast	C50	832	818	822	164,4	130,7	123,9	129,7
Malign uterine cervix	C53	47	43	45	9,0	7,7	8,5	7,6
Non Hodgkin linphoma	C82-85,96	132	115	105	23,4	16,8	13,2	13,1
Leuchemia	C92-95	45	65	47	10,4	7,5	8,3	9,0

Compared to other areas, the Upper Seriana Valley, has relatively higher incidence values for bowel-rectum tumors in males (Figure n. 23). It has been known for some time that the origins of this type of neoplasia play an important eziological role linked to diet (e.g. foods with a high content of animal fats and shortage of fibre) and genetic factors (Ref. 55).

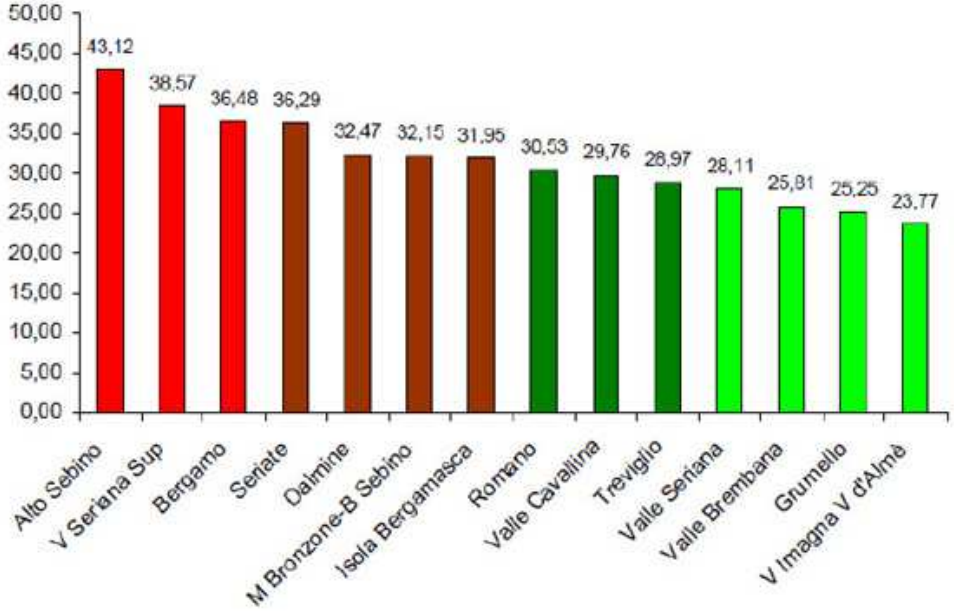


Figure n. 23. Epidemiology of tumors in ASL health districts in the Province of Bergamo (1999-2006). Standard annual mortality rates (x 100.000) for tumors of the bowel-rectum in males (ASL Bergamo, Ref. 22)

Figure n. 24 describes the epidemiology of breast and prostate tumors recorded in the ASL health districts of Bergamo, also during the period 1999-2006.

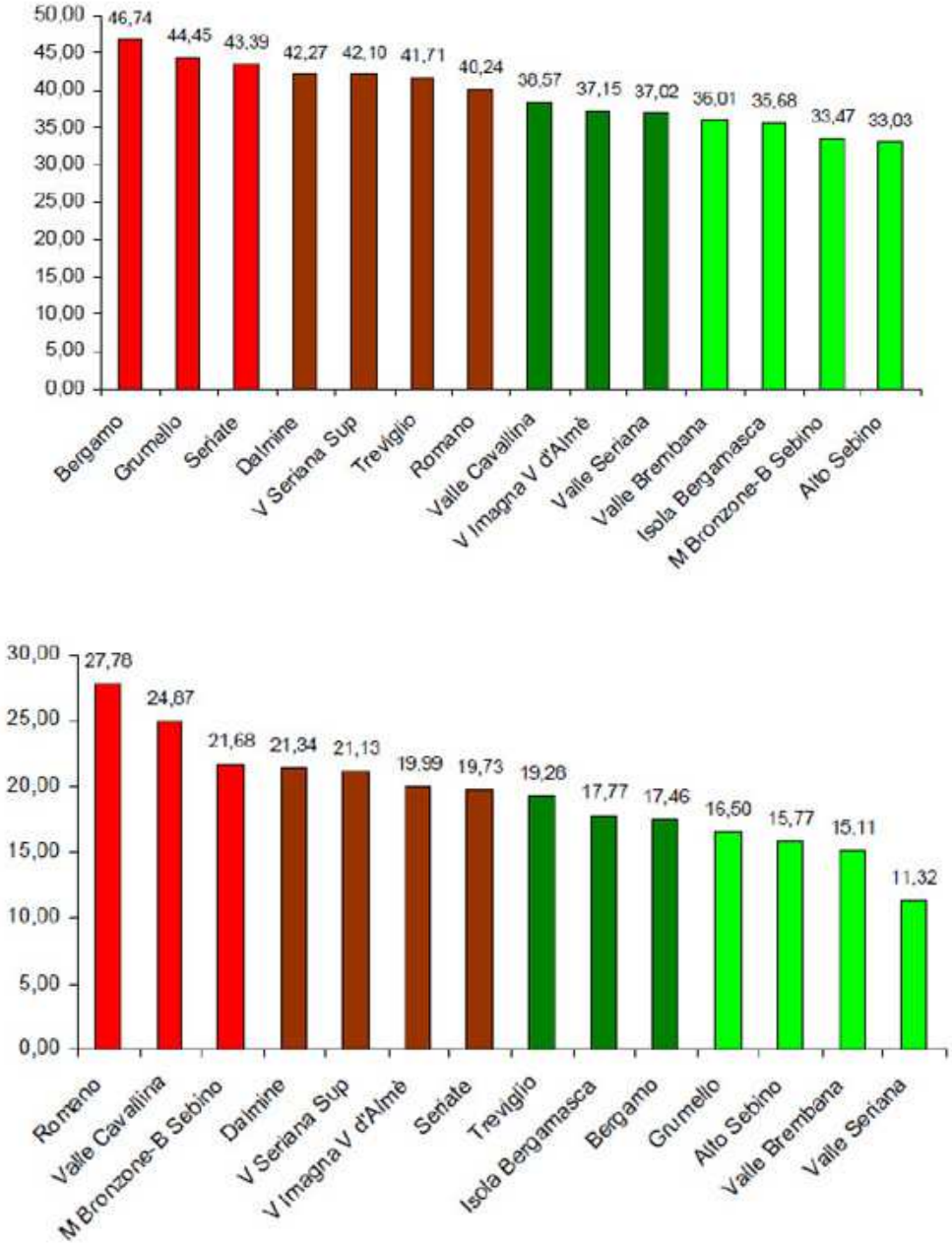


Figura n. 24. Epidemiology of breast tumors (above) and prostate tumors (below) during 1999-2006. Standard annual mortality rates (x 100.000) per health district (ASL Bergamo, Ref. 22)

In short, recent epidemiological data shows that in the Upper Seriana Valley mortality rates for tumors do not present abnormalities compared to other health districts in the province of Bergamo.

Further information on this subject can be taken from a document called "Synthetic Report year 2011" ASL Bergamo – Department for Medical Prevention, regarding the Upper Seriana Valley and Scalve Valley health districts (Ref. 108). The rate of mortality linked to illnesses of the circulatory system are considerably high in males (+9%) and of the respiratory system (+30%) and ischemic cardiopathy (+19%), pathologies where unhealthy life styles play an important role.

This aspect was also taken into account in a study, PASSI 2008-2009, that the ASL health office of Bergamo carried out together with the Higher Institute of Health (Istituto Superiore di Sanità), examining by means of telephone interviews routine behavior of citizen in the Province aged between 18 and 69.
Data collected on life styles are shown below.

- *Physical activity*: 19% of residents lead sedentary life styles **(**compared to 20% in Lombardy as a whole and 30% on a national level), but only 38% follow the recommended amount of physical activity;
- *Nutrition and dietary habits*: 34% of Bergamese are overweight (compared to 35% at a regional level and 42% at a national level), 26% for excess weight and 8% per obesity; consumption of fruit and vegetables is quite common though only 17% of interviewees have the recommended five portions a day;
- *Consumption of alchohol*: 62% of Bergamese consume alchohol regularly (compared to 69% at a regional level and 57% at a national level), but in the 18-34 age group this rises to 72%; 21% are drinkers at risk, 8% are binge drinkers and 5% are heavy drinkers;
- *Tobacco smoking*: 26% of the population are smokers (compared to 29% at both lombard and national levels), 20% are ex smokers; over the last year 41% of smokers tried to stop; 80% of Bergamese don't allow smoking in the home.

This type of data is worth mentioning as an addition to the subject being discussed here. As far as tobacco is concerned for example, we already know that smoking contributes considerably to the intake of harmful chemicals into the body. Cigarette smoke contains aromatic polycyclical hydrocarbons and toxic metals. From a packet of cigarettes a smoker absorbs about 20 mg di cadmium, that is to say a fifth of the maximum daily dose a man can tolerate.

7.1.3. Other factors of interest to the health. A test on accumulated impact was carried out. Effects on public health, in a final analysis, depend on the value of a series of pressure factors that are present in the area rather than the effects from a single source of pollution.

In the area where the Pontenossa site is located, accumulated effects of an industrial nature can be reasonably excluded. The area is not heavily industrialised. There are no other significantly large production sites in the vicinity of the plant apart from Lamiflex, a company of 50 employees which produces laminate composites. Considering the nature of these production processes, there are no reasons to hypothesize any interactions or cumulative impact that can be of relavant interest to health. As far as we know, there are no other production sites planned for the area that could modify current circumstances.

It would be worth turning our attention to radon gas, a natural radioactive gas potentially cancerongenous which, when in excess quantities, can increase statistical risks of developing lung neoplasia among the population. Regional recording program carried out in recent years show high concentrations of radon gas in various areas of the Upper Seriana Valley, including the area around the Pontenossa site (Ref. 108). Radon gas comes from the subsoil. Once it reaches the surface it is dispersed into the open air while when it penetrates inside buildings it accumulates into a concentrated form especially in badly ventilated rooms. The increased risk of lung neoplasia due to cronic exposure to radon is practically unknown to the public even though it is a problem that shouldn't be ignored from an epidemiological point of view (Ref. 119).

7.1.4. Sinthesis of evidence - uncertain areas. The aims of the white Paper are to put together a primary attempt to under stand the scientific context in relation to the environment, public health and industrial activities that use the Waelz process. This type of plant has been around for some time in other parts of Italy and other European countries. Technical and scientific literature doesn't highlight environmental or health issues in the geographical areas where these plants have been built.

In accordance with this data, no particular demographic or health problems emerge regarding the local population living in the area where the Pontenossa site is situated. Chemical agents present in emissions are largely within the limits laid down by law and the air quality in the area around the plant shows no abnormalities and is certainly better compared to many urban areas in Italy. More marked differences would be evident in national territorial areas where there is heavy industrialization, as for example those examined in the recent epidemiological study "Sentieri" (Ref. 83).

A formal health impact assessment (VIS) would perhaps aloe for a more circumstantial judgememt of the impact of the Pontenossa site compared to what comes out of this study. However, in light of the available data, this type of test would not seem to require priority over other research projects.

Clearly these conclusions must not discourage a lack of caution, as in the complex analysis of data linked to the relationship between environment, pollution and health. In this sector it is difficult to analyze specific cases using criteria regarding "public medicine based on evidence" (Ref. 2), given the relevance and dimension of uncertain factors (Table n. 29) and the considerable void between what we know and what we still need to know.

Table n. 29. Uncertain factors in assessing the relationship between pollution and health
Epidemiological and toxic assessment using methods and criteria that science claims to be outdated and in need of improvement (Ref. 98)
Arbituary choice of models
Biostatistical data elaborated without decribing the margins of uncertainty of the assessment (Ref. 97, 100)
Elaborate the distinct characteristics of single scenarios from one environmental situation to another without detailed testing and the size and weight of confusing variables.
Lack of multidiciplinary and trans diciplinary actions in the assessments

7.2. Workers health

The number of Pontenossa S.p.A. employees are currently seventy eight (Table n. 30). These include technical and admin staff, control personnel in charge of the functioning of production lines, factory floor staff (in charge of moving and preparing raw material and processing slags), maintenance and service staff and general services staff.
The company works a continuous cycle of three shifts, seven days a week.

Table n. 30. Pontenossa S.p.A.workforce and professional status of personnel (data up to 31 december 2012).

Area	Number
Company management	1
Factory management	1
Sales services	1
Technical office	4
Prodution	39
Maintenance	17
Disposal-Ecology-Quality	1
Purchasing and shipment	1
Warehouse	1
Chemical lab	4
Prevention and protection services	1
General and industrial accounts – Staff amministration	4
General services	3

7.2.1. Monitoring of risk factors in the work place

Previous sections of the White Paper dealt with materials and substances inside the plant and thier relative toxic classification. The chemical agents with the highest risk to staff are dust particles, lead and cadmium. Lower down the scale is zinc which i salso present in the production process but is less aggressively toxic.

Pontenossa conducts monitoring programs on these agents in the workplace in order to evaluate worker exposure in conformity to regulation D.Lgs. 81/2008 s.m.i. The most recent (may-december 2011) was carried out by the Environmental Research Centre of the IRCCS Fondazione Maugeri Foundation of Pavia using samples from fixed positions and personal samples personali (Ref. 25). Measurements taken referred to inhalable dust from metals (lead, cadmium, zinc), solvents and flying organic substances.

Results show a workplace without any substantial abnormalities. In each department, work station of duties examine, concentrations of inhalable dust were always well below basic value limits – average over time (TLV-TWA) suggested for 2011 by the American Association of Industrial Hygienists (ACGIH).
For inhalable dust, 8 out of 13 were below 1/10 del TLV, four below 2 mg/m^3 and one in the range of 3.44 mg/m^3, compared to a TLV-TWA value limit of 10 mg/m^3. In tests made on fixed work stations and areas where there is movement of dust-creating material, the highest values were registered. Concentrations of inhalable dust measured in areas where workers

manage plant activities and can breathe it in, are in the range of 0.16-1.6 mg/m^3.

The concentrations of inhalable dust were between tra 0.1 e 0.77 mg/m^3, with the exception of one measurement of 1.11 mg/m^3 (TLV-TWA value limit for an inhalable fraction is 3 mg/m^3).

Metal concentrations (zinc, cadmium,lead) found in inhalable dust, frazione that refers to the value limit ACGIH (2 µg/m^3) were all well below the afore mentioned TLV. In the case of cadmium, analyses highlighted concentrations below recorded analytical limits. For lead, (inhalable fraction), in a fixed position near the "Exchanger Zone" – Cooling Tower (an area not normally visited by staff), a higher concentration (61.5 µg/m^3) to TLV-TWA of the ACGIH (50 µg/m^3) was recorded, but was below the 75 µg/m^3 limit established by D.Lgs 81/2008. This fact has no significant effects on worker exposure considering the measurements carried out in breathing zones. This does require however, a deeper understanding in order to establish its actual meaning.

Concentrations of flying organic substances (expressed as n-hexane) are included in an interval between 1 and 6 µg/m^3, an irrelevant quantity compared to the value limits.

7.2.1. Health Surveillance Activities. An idea of these activities are illustrated in a Document written by the company's appointed doctor dated January 2012 (Ref. 26). Workplace risks kept under control tend to be of a traumatic nature (mechanical, electrical, over heating, chemical) and the chemical or physical kinds (noise), to which prolonged exposure could result in infirmities that are dubbed "professional". Plant characteristics and company procedures enable prompt intervention for potentially harmful duties and the different types of worker exposed.

The whole internal program for health protection of workers involves regular annual medical check-ups and regular biological monitoring of professional exposure to risk factors. For health surveillance activitis, Pontenossa have appointed an experienced professional doctor, Dr Angelo Rebba, specialist in diseases of the repiratory apparatus, allergies and workplace medicines – internal medicine. He is entrusted with the job of keeping and up-dating a health and individual risk file for every employee in compliance with 70 D. Lvo 25 February 2000, n. 66 and D. Lvo 10 April 2006, n. 195.

This activity is carried out according to programs that are formulated and improved over time. Clinical assessments are completed by means of spirometric tests and lab investigations which measure exposure indicators and effects in biological examination (blood, urine). Worker exposure is checked on a regular basis. Monitoring data is compared with professional exposure limits established by law. In cases of individual needs, extra clinical analysis is provided.

Exposure to noise can be considered of a constantly average level given the type of plant being used which requires dynamic mechanical instruments and components for the treatment of Waelz dust and the varying movements of the machinery. Phomometric recordings that are periodically carried out (the last one in november 2011), exclude exposure over 85 dBA. Audiometry is done as soon as a worker is empolyed and continues also afterwards.

In 2011, suitability was judged according to the type of duties involved and confirmed using regulations and limitations that were in force in the past. These conditions are applied to less than twenty employees in the company out of a total of eighty males employed in production, logistics, maintenance, lab and support services.

Exposure to lead is checked every six months conducting a test of two biological indicators: piombemia and zinc protoporfirine. Figure n. 25 shows some data of the piombemia test results on employees between 1998-2012. Indicator values offer clear evidence of the significant improvements made over the years regarding worker exposure to lead at Pontenossa. The value of zinc-protoporfirine IX erythrosin has fallen contantly lower than the limit of 12 µg/gHb.

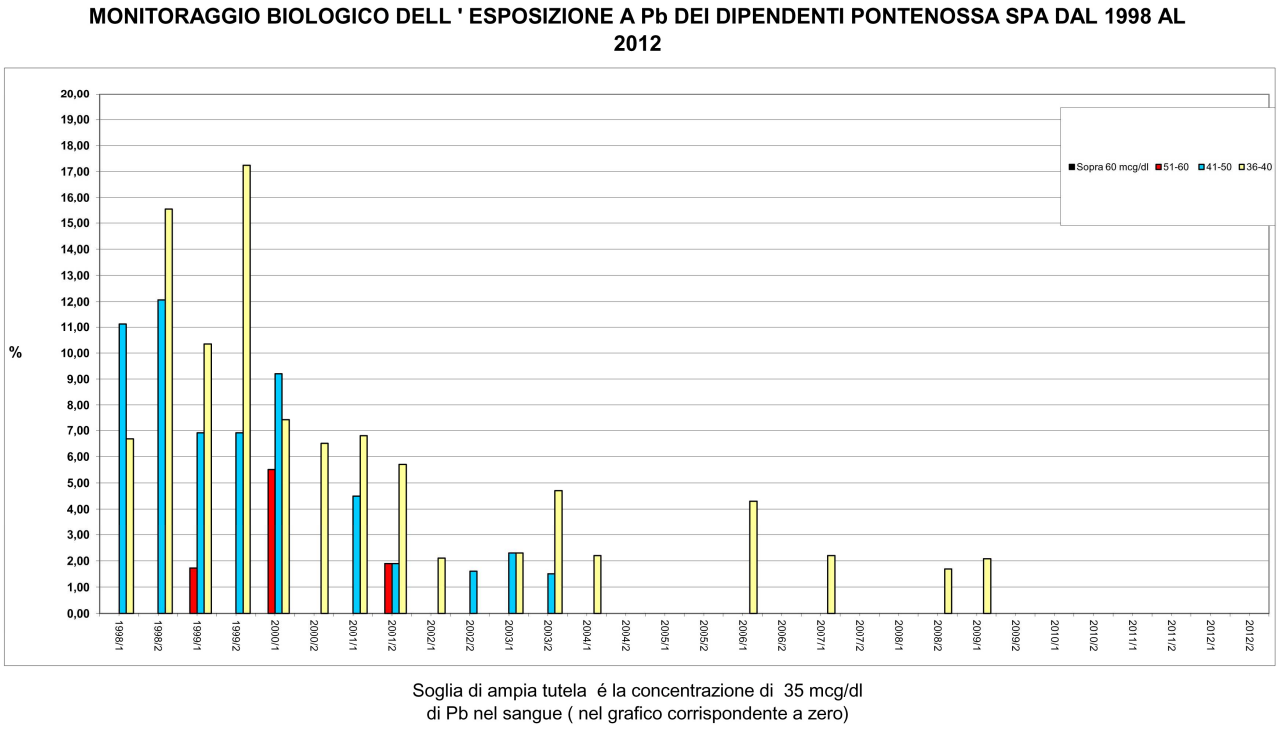


Figure n. 25. Piombemia values.

As far as cadmium is concerned, surveillance of single workers is carried out on a regular basis by measuring urinary levels of the metal every six months. Recorded values are placed within intervals of non exposure (note: l'IBE ACGIH 2012 for Cd is 5 µg/g creatinine).

According to an accepted tradition over the years, all employees are offered the possibility to undergo an ample range of lab tests. There have been no problems worth mentioning from the results of these tests. In aid of prevention, also doses of PSA are administered to males above the age of 50.

In 2011 everyone was able to take part in a revised cardiocirculatory check-up program including electrocardiogram, arteriole pressure tests, body weight and body mass index.This program was continued into 2012.

The possibility to choose anti-flu treatment was also introduced and 25% of employees took part.

Complementary health activities are regularly carried out as required by standards involving an appointed doctor (on-the-spot inspections, meetings with RSPP and RLS, annual meetings, etc.). A repeated network of widespread and intense information and training has been carried out regarding drug taking or ingesting psychotropic substances and drinking alcohol, all of which are forbidden by law and are particularly directed to work duties taking that have been coded (D.Lgs. 81/2008, art. 41, comma 4-bis).

Recent clinical assessments in line with those of previous years, confirm that: (i) no wear and tear tasks have been identified within the company (except for the night shift rotation hours) (ii) All employees have been placed in work stations where there are no individual counter effects, (iii) also in 2012 there were no health problems linked to professional illnesses or problems referring to the job or the job environment.
In the last decade Pontenossa hasn't had to make any type of report for professional illnesses. (comunication, November 2012).

7.2.2.Accidents. During 2012 Pontenossa registered a total of six accidents that requie 28 days of sick leave. In a full assessment of what happened, we can refer to the types of accidents at work registered by the ASL district health offices of the Upper Seriana Valley and Scalve Valley. Between 2006 and 2010, accidents at work and defined positively by INAIL added up to1781, with annual values that range from 291 in 2009 and 435 in 2006 (Ref. 108).

7.3. Codes of conduct

The company makes use of Model "231" (ex-lege dlgs. 231/01), together with an internal Code of Ethics which contain the most important rules of behaviour to which all employees and collaborators have to adhere with the aim to ensuring a suitable working environment from a safety and personla health point of view. This is also maintained by investments in plant and machinery in order to improve safety standards and in compliance with legal regulations such as art. 30 of D.Lgs. 81/2008 e s.m.i.

For the more “sensitive” activities specific regulations are applied: people inside the production zone must (i) observe the accident prevention regulations for health and hygiene at work hence contributing to maintaining a safe and healthy environment; (ii) respect the accident prevention and protection measures provided by Pontenossa and report any irregularities and/or malfunctionings that may arise because of them to the Prevention and Protection Services; (iii) Take active part in informative and training sessions on specific risks linked to the duties entrusted to them by the Company; (iv) report to the Prevention and Protection Services if any evident risks arise from activities connected with consultants, partners, suppliers with regular work contracts or sub contracts and all those who work on company sites.

Pontenossa carries out regular training courses and practical training sessions to make sure staff are qualified in matters of safety, chemical risk, risks linked to use of equipment, disposal, first aid, fire extinguishing, environmental management systems, SISTRI and D.Lgs. 231. During the whole year training is practiced in order to reach and maintain adequate standards for safe use of the plant and dealing with emergencies. In view of this aspect (to be treated later in this Paper), each worker is well informed in accordance with the requirements of D.M. 16/03/1998 and s.m.i., for what concerns relevant accident risks, material safety sheets, public information sheets, internal emergency plans, use of safety equipment.

The training program is available to all workers (including staff from other businesses). The management, the head of the Prevention and Protection Services and department heads overview informative and training needs and regularly draw up plans that take into account any variations of risk and the technological evolution of the company.
The company has put into action a planning procedure for training programs (Procedure SG22) which is regularly checked for its effectiveness.
Those in charge of first aid have already taken part in basic training and regular upgrading courses since 1999 followed a specific upgraded course in 2012.

In short, all available company data show that Pontenossa respects the requirements laid down by D.Lgs. 231/2001 and D.Lgs. 81/2008 in matters of the health and safety of workers. Particularly, (i) technical and structural standards relating to equipment, machinery, work stations, chemical, physical and biological agents; (ii) the risk assessment document is duly kept up to date with prevention measures and consequent protection; (iii) organizational activities are regularly arranged such as emergencies, first aid, occasional meetings on safety, meetings with workers’ representatives regarding safety; (iv) activities such as health surveillance, monitoring of chemical pollutants within the plant and training and information for workers are carried out; (v) periodical tests are made to check the application and effectiveness of the procedures.

8. SAFETY – ACCIDENT RISKS

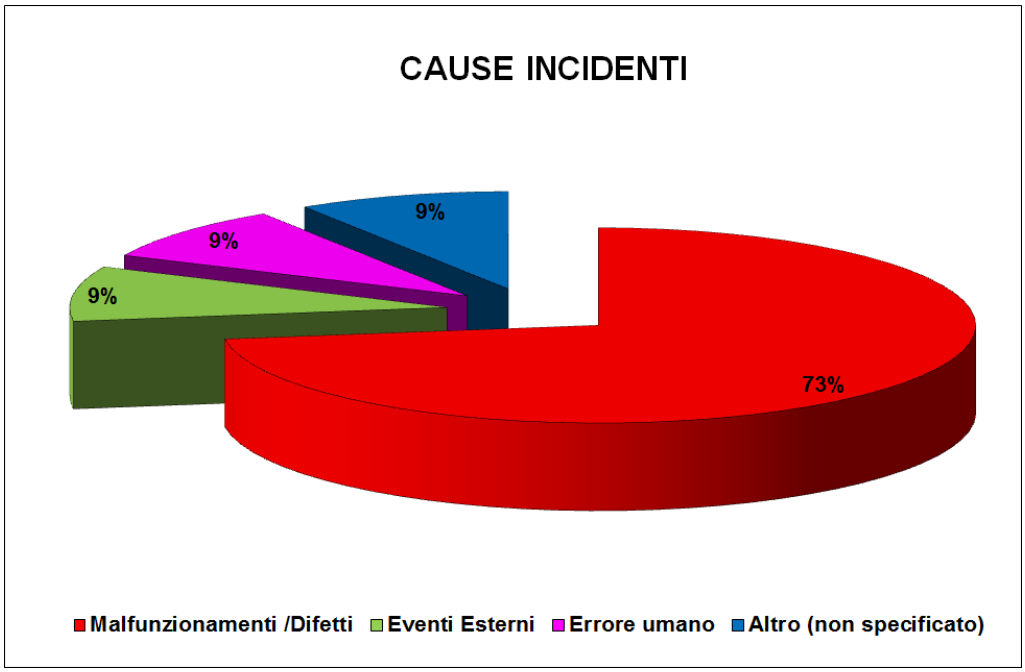
Pontenossa S.p.A. has to comply by the requirements of art. 8 del D.Lgs. 334/1999 for quantities of product (Waelz oxide) that are higher than the levels established by law and waste material (steel work fumes and others) both classified as dangerous for the environment. In accordance with regulations established by law (D.Lgs 334/99, Ministerial Decree for the Environment 9 August 2000, D.Lgs 238/2005), the company has applied the Safety Management System for the prevention of serious accidents related to dangerous substances within the plant.

The safety Report (Ref. 57) gives a detailed description of the nature of risks within the plant and the vulnerable areas around the site (houses nearest the site's baricentre are only 300mt away; the centre of Ponte Nossa 1000mt away). The frequency of potentially dangerous events are then evaluated and identified as "reasonably predicatable events" to which prevention measures are applied such as surveillance, staff training and drills, the priciples of intervention and action plans.
The report also takes into account the consequences of accidents in terms of damage to the environment and to the population.

"Credibile" scenarios that have been identified by risk analysis, are mainly to do with dust dispersion in air of zinc oxide and lead whose possible consequences seem to be limited to the inside area of the site.

The site has a room equipped as an infirmary with instruments and medical material for any initial intervention. All parts of the plant and production areas have security signals that comply with D.Lgs. 81/08 and s.m.i. The plant area is designed so that staff can easily get away from a danger zone and access medical aid and fire extinguishers. The site has a research system and ensures continuous communication with the outside where there is an open access to the plant 24 hours a day. Authorized access is provided to staff.
A fixed fire extinguishing network is available consisting of sprinklers along the perimeter of the plant and the internal production areas. Wall fixed and mobile extinguishers are placed around the inside area of the site. In the CED room extinguishing equipment functions on Nitrargon gas. In the electrical sub station there is a foam extinguisher and wall fixed extingishers using CO_2.

Hold-up is determined by means of individual assessment of equipment containing dangerous substances; volume is evaluated starting with geometric data and then the actual volume occupied by dangerous substances. The index of each unit has been determined: (i) fire, (ii) confined explosion, (iii) air explosion, (iv) general risk and (v) toxic risk. The calculation of toxic factors **Tu**, are carried out on substances dangerous to the environment following indications of the D.P.C.M. 31/03/1989 which shows that none of the examined units (stock and transfer of steel work fumes, Waelz process) have a high risk index.



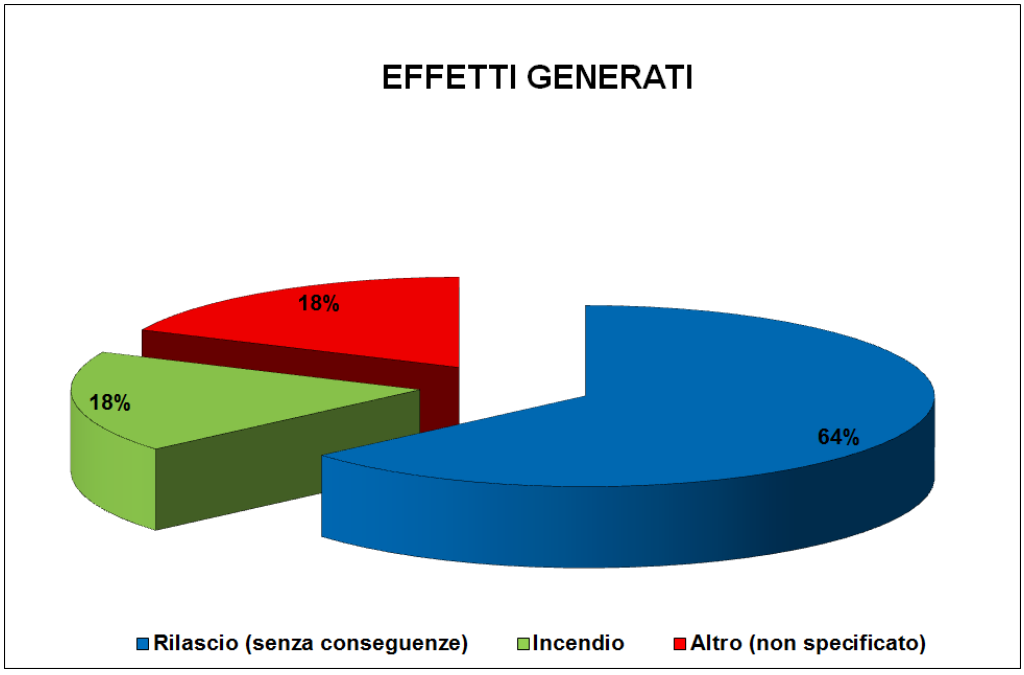


Figure n. 26. Analysis of accidents (n. 11) in Pontenossa from 2006 to 2011.

Figure n. 26 illustrates an analysis of past data regarding accidents that have occured in Pontenossa from 2006 to 2011. Statistics are based on a limited number. The effects of fire recorded are linked to maintenance activities carried out by external comapanies, they are not related to the production process.

From past research on accident cases in similar plants to the one in Pontenossa (carried out through consultation of the data bank MHIDAS - Major Hazard Incident Database Service) there have been two accidents involving zinc oxide and lead. Records have been described in attachment 1.C.1.1.2 of the Safety Report (Ref. 57). Lead oxide was upset during transportation due to a mechanical fault combined with an operative error, while zinc oxide was involved in the outbreak of a fire by unknown causes together with other dangerous substances in the company where it was stocked.

Past data does not highlight effects due to earthquakes, floods, tornadoes, and lightning which has targeted plant installations. The Pontenossa site is located in a low sismic area (zone four) according to Ordinance PCM of 20 march 2003, n. 3274. There is no recorded evidence that tornadoes have ever had effects, in terms of security, on plant installations. As regards lightning, the area where the plant is situated has been classified by Standard CEI 81.3 to be among the areas that have a frequency of lightning of 4 per year per km^2.

Table n. 31 Shows estimates of hyopthetical occurances and their possible frequencies as described in the Safety Report (Ref. 57).

Table n. 3. Accidental hypotheses.

N.	Type of hypothesis	Item	IDENTIFIED ACCIDENTAL HYPOTHESIS	Frequencyof occurance (occ/anno)	Frequency Class CIMAH	Frequency Class D.P.C.M. 31/03/89
1	Operative analysis	Waelz Furnace	Overpressure inside the Waelz furnace	$2,6 \cdot 10^{-4}$	Very unlikely	Low
2	Random	Waelz furnace burner	Release of methane from burner valve of Waelz furnace	$8,4 \cdot 10^{-5}$	Unlikely	Very low
3	Random	Boiler burner chrystalization plant	Release of methane from boiler burner valve of chrystalization plant	$8,4 \cdot 10^{-5}$	Unlikely	Very low

8.1. Dangerous dispersion for the environment

Substances that could be released into the atmosphere in the case of an emergency in a critical area (Waelz plant) are carbon monoxide and waelz oxide dust which contain zinc oxide and lead oxide (Table n. 32). Both these oxides are classified as “substances dangerous to the acquatic environment”.

Table n. 32. Estimates of the release of dangerous substances in the case of an accident.

SUBSTANCE	LIMIT
CARBON MONOXIDE	**LC_{50}** 3033 mg/m^3 **IDLH** 1380 mg/m^3
LEAD OXIDE*	**IDLH** 100 mg/m^3
ZINC OXIDE*	**IDLH** 500 mg/m^3

* = Lead IDLH has been taken as a reference for lead oxide.

The Safety Report (Ref. 57) gives a detailed description of scenarios and hypothetical release values based on simulated studies of accidents that involve the above mentioned substances. As an example Table n. 33 possible consequences following the release of lead and zinc oxide dust.

Considering the prevalent direction of the wind, the height of the surrounding buildings and the height of the perimeter wall that separates the plant from the Riso Torrent riverbed, the results of simulations would lead us to believe that any consequences would be limited to inside the site. Water falling onto the plant floor surface (first rainfall) is collected and transported to a big basin, while other tanks are available for any overflow. After that the water is sent to the company depuration plant.

Table n. 33. Description of two hypothetical accident scenarios (Ref. 57).

SCENARIO A: DISPERSION OF LEAD OXIDE. A cloud of lead oxide forms and is released into the environment. Furthermore, even after the event has been spotted, dispersion does not cease immediately but continues until all the fumes inside the furnace have been exhausted. The worst conditions would be reached in a time range of 30 minutes.
In Table 33-A the release of lead oxide has been calculated at various distances in windy conditions at an altitude of 1,7 mt, corresponding to a man of average height and cautiously hypothesizing a release altitude of 0 meters.

Table 33-A. Calculation of lead oxide dispersion in the case of an accident.

WIND SPEED (m/s)	STABILITY CATEGORY (-)	DISTANCES (mt) WITHIN WHICH CONCENTRATIONS ARE REACHED*
		IDLH
Raw material loading area and furnace-chamber capacity		
2	F	243
5	D	130
Slag disposal area		
2	F	276
5	D	147

*calculations made using the ALOHA program

SCENARIO B: DISPERSION OF ZINC OXIDE. A cloud of zinc oxide forms and is released into the enviroment. In Table 33-B the release of zinc oxide has been calculated at

various distances and in windy conditions, at an altitude of 1,7 m, corresponding to a man's average height cautiously hypothesizing a release altitude of 0 mt.

Tabella 33-B. Dispersion estimate of zinc oxide in the case of accidents

WIND SPEED (m/s)	STABILITY CATEGORY (-)	DISTANCES (mt) WITHIN WHICH THE CONCENTRATION IS REACHED*
		IDLH
Raw material loading area and furnace-chamber capacity		
2	F	231
5	D	64
Slag disposal area		
2	F	270
5	D	75

* calculations made using the ALOHA program

8.2. Prevention measures

The Safety Report (Ref. 57) gives a detailed description of precautions related to the plant and its operative functions in order to prevent accidents and also the care needed to avoid human error. The assessment takes into account all possible scenarios in work situations, i.e normal working conditions, emergencies, tests, programmed shut down and emergency shut down.

The plant has a fire detecting system located in the site's main electrical unit and in the data processing centre in the office building.These systems are checked by an externally specialized company that carry out annual checks.

To mitigate the effects of these accident scenarios, Pontenossa has also installed various detecting systems according to the times indicated in the Plant Safety Report, in particular: (i) A video camera system connected to the control room that films the connection area of furnace-chamber dust so that any release of dust is detected (TOP EVENT 1); (ii)Inflammable gas detector near the group of valves and flange coupling not far from the Waelz furnace methane gas burner (TOP EVENT 2), which sends an alarm signal to the control room; (iii) Inflammable gas detector near the group of valves and flange coupling not far from the methane gas burner, the oiler and the crystallization plant (TOP EVENT 3).

There is also a video camera system in the raw material loading area of the Waelz furnace plant (linked to the control room) and another video system in the slags disposal area so that any release of dust can be detected (Top Event 1). The latter system (slags disposal section) can also cover the area of the methane gas burner (Top Event 2).

The Safety Management System was put into action at the beginning of March 2006 which was when Pontenossa S.p.A. first adopted art. 8 of D. Lgs. 344/99 and s.m.i.). The system is backed up by a series of manuals, procedures and operative instructions. It is periodically tested and revised by a Commitee nominated by the Minstry of the Environment.

Pontenossa S.p.A. is covered by an insurance policy for “civil responsability against pollution”. The value of damages to people or things is 2.000.000,00 € per accident per year. The policy expires annually on 31st december, with automatic renewal.

9. SOCIAL SUSTAINABILITY

9.1.Introductory concepts: a modern address to sustainable development.

Sociologists and economists teach us that wealth is generated from the ability to make use of goods/services that satisfy expectations. Such availability comes, first of all, from the production of these goods and often requires activating processes of transformation of natural resources using technology created and controlled by man. Finished products reach the final users by means of distribution processes which also use up resources. The consequences of this behaviour contribute to the concept of "globally sustainable development". The creation of all kinds of goods/services inevitably involves resources which are partly returned to the environment in the form of waste and/or potential loss in more or less relevant proportion depending on the efficiency of the productive system. This is where the role of a business becomes important both from a technical viewpoint as from a more general aspect as far as development policies go. A company's aim should be to maximize yield from the use of resources. This means creating products (or services) of high quality and social utility while using a minimum amount of resources per product item and a minimum amount of waste. The role of a business is to maximize the production of real wealth while respecting the resources made use of. Once this social function has been recognized, it is the company's duty to keep economically healthy because its existence and development generate a flow of wealth destined to spread throughout society.

A key reference to this sustainable model are the so called "eco system services", or in other words, intelligently safeguarding all benefits coming from nature (food production, drinking water, making soil fertile, etc.) which are substantially linked to the concept of "wealth" (Ref. 105). Wealth can be identified as the obtaining of "freedom", "freedom to choose" and access to material resources and income, in an ideal world where people can live in a clean, safe and healthy environment, in a system protected from disease and with the possibility to cultivate cultural, spiritual and leisure activities.
Widespread opinion is that if, on the one hand, demand for eco system services is on the increase, the capacity to satisfy that demand is declining due to changes introduced by man. The social cost of certain models of development would appear high.

In an industrial world, sustainable development not only means economic development (generating work and income) but also respect for the environment and social responability (a guarantee of safety and health). From this viewpoint sustainability takes on the meaning of "moral principle" that the single individual should respect, to safeguard over the years, the interests of the individual and the common good.

In view of all this, environmental sustainability can be pursued by companies adopting an economic, productive and organisational approach which can follow three directions: (i) limit the resources they draw on depending on their durability and possibility of renewal, (ii) reduce contaminated waste and the degenerative effects they produce, (iii) promote potential and innovative ideas both in the production of goods and in the fight against pollution. In order to contrast negative environmental changes due to human activity, it will be necessary to implement healthy policies and strategies that have a greater effect than the changes produced.

9.2. Company policies and strategies

Company strategies that comply with legal standards, internal Code of Ethics and important social and economic aspects, are in line with the priciples and objectives mentioned above.

9.2.1. Conformity to standards. Activities undertaken by Pontenossa S.p.A. are subject to authorization as far as the production of Waelz oxide from steel work fumes is concerned including also zinc waste storage and slag disposal to a single waste dump next to the production plant (Ref. 16).

Contained in the Appendix is the text of the attached document “Analisi Ambientale Iniziale Pontenossa S.p.A. Initial Environmental Analysis” (Ref. 6), with a Check List of legal conformity, the list of regulations expressed in the various decrees and the actions taken by the company in order to conform to the requirements of the law. The pictue shows the commitment of full comformity to standards and punctual response to the regulations established by the authorities regarding safety, health protection for workers, noise, waste management, energy saving, water resources, emmissions and integrated control of pollution.

In finalized programs and in those still under way, the aims of compliance to standards combine with research and development. Investments have been made with the aim of developing new technologies to contrast pollution. One example is the procedure for reoxidizing iron during the Waelz process which enables the reduction of carbon in the incoming mixture. The Waelz process has undergone continuous improvements to optimize the production cycle and reduce risks in the work place and in the environment. Experiments are being carried out on techniques that could enable the recycling of waste products from the Waelz process as an alternative to dump diposal. This research is of considerable value for the possible recycling of waste as an inert material for building and for use in road surfacing.

With reference to liquid emissions, the plant cooling liquid that washes the waelz oxide can be reused and in equal measure to reduce the supplies of industrial water (Ref. 16).

9.2.2. Code of Ethics. The company code of ethics takes reference from the Organization, management and Control Model adopted by Pontenossa S.p.A. according to articles 6 and 7 of the D.Lgs. n. 231/2001 and the "Guidelines for creating organization, management and control models", ex D.Lgs 231/01, " from Confindustria (Union of Industrialists) 07/03/2002 (Ref. 63).

The Code of Ethics recognises the importance of ethical and social responsibility and safegurding the environment while carrying out company activities. The policies put forward three priorities: (i) integrate environmental aspects at various management levels in the company, (ii) apply a system of planning, control and management suitable for sustaining this integration, (iii) encouraging public participation and all those involved.

The Code of Ethics commits the company to applying the best available technology and to developing its own activities with suitable programs that make the most of natural resources and preserve the environment. The company promotes safety culture and gives special attention to safeguarding the environment, mainly through preventive actions, and takes into account things such as energetic efficiency and health and safety conditions in the work place. (Ref. 63). The company Code also expects that research and technological innovation are implemented to create pocesses that are as compatible as possible with the environment, with safety and workers' health.

To reach these objectives the company is making use of internal management and control systems, e.g. environmental certification systems which will be discussed later.

The fact that the concept of sustainability is an important issue in Pontenossa is positive in terms of balance and exchange between ecology and economics, health rights, labour rights and the competitiveness of the company. Circumstances indicate that a limited vision of the situation has been formed, fostered by conflicts and controversy and, in the research of solutions, groups of citizens, entrepreneurs, workers etc. choose to take sides and decide which rights deserve more priority compared with others. In the fight for rights, those concerning health and jobs, enviroment and employment are among the most common. In this case public opinion is encouraged to choose between employment and environmental risks that is, between a concrete and immediate disadvantage (loss of jobs) and a medium and long term benefit (reduction of disease caused by pollution) whose gravity is uncertain and can only be measured approximatively in terms of probability.

The principles of behaviour and control are found in the company's own standards represented in model "231" (code of ethics, general and specific etc.) and in management systems for safety, the environment and quality (policies, manuals, procedures, instructions etc.). hence maintaining fulfilment of the requirements laid down by law regarding the protection of the environment and health and thus avoiding legal proceedings of those concerned.

9.2.3. Legislative decree 231/2001 and risk of criminal offences to the environment. D.Lgs n. 121/2011 has extended company responsability to specific environmental offences. The activities of Pontenossa S.p.A. considered "sensitive" according to art. 25-*undecies* of D.Lgs. 231/2001 are (i) defence of the soil, protecting water from contamination, management of water resources; (ii) waste management and restoring polluted areas; (iii) safeguarding air quality and reducing emission into the atmosphere; (iv) compensatory protection against damages to the environment.

The main offences that can be commited in the sector where the above mentioned activities are carried out are listed in Table n. 34.

Table n. 34. Risk of offence for "sensitive"activities in the field of environmental protection (D.Lgs. 231/2001)

▪ Collection, transport, recovery, disposal, trading and mediation of waste in the absence of obligatory authorization, application or communication (art. 256 c. 1 D.Lgs 152/06); ▪ Creation or management of non authorized disposal sites (art. 256 c. 3, D.Lgs 152/06); ▪ Mixing of dangerous waste material (art. 256 c. 5 D.Lgs 152/06); ▪ Violation of compulsory communication, obligatory registration and form filling (art. 258 c. 4 second period D.Lgs 152/06); ▪ Organised activity of waste smuggling (art. 260 c. 1 D.Lgs 152/06); ▪ False description relating to the nature, composition and chemical/physical characteristics of waste material or providing false certification of data required for traceability of waste products (art. 260 bis c. 6 D.Lgs 152/06); ▪ Exceeding emission value limits which also determine contemporary excess of air quality value limits (art. 279 c. 5 D.Lgs 152/06); ▪ Discharge of industrial refluent water containing dangerous substances included in the groups of substances listed in tables 5 and 3/A of Attachment 5, part three, TUA (art. 137 c. 2, 3 and 5 D.Lgs 152/06); ▪ Omitted recovery of sites that must conform to approved projects by the appointed authority (art. 257, commi 1 and2 D.Lgs. n. 152/2006); ▪ Killing, destroying, capturing, removing, detaining protected specimens of wild animals or vegetables (art.727-bis c.p.); ▪ Destruction or deterioration of natural habitats within a protected area. (art. 733-bis c.p.).

9.2.4. Important social and economic programs. The presence of Pontenossa offers a significant support to the local economic context in terms of employment and effects on local services (service industries, transport etc.). The site has also been useful to the development of other entrepreneurial businesses. In recent years, during this generally difficult economic period, the company has adopted policies aimed at maintaining full productive and occupational capacity with constant support of the territory.

On various occasions, Pontenossa has given support to the creation of social and cultural projects of public interest and to improving living standards. Examples include the development of a local library system, the economic convention with the towns of Premolo e Gorno and the creation of the Riso Valley cycle path.

Pontenossa is also involved in supporting educational programs, training and instruction for students, contributes to school activities and the local library system and to social, cultural and leisure projects in local towns.

10. CRITICALITY

Tests carried out refer to: (i) prevention measures or improvements not necessarily done in the the expected times or ways, (ii) interventions that didn't produce the expected results, (iii) new situations with potential impact on safety, and public health.
Criticality related to these aspects can determine standards of non conformity or irregularities that are in contrast to the environmental policies established by Pontenossa.

10.1. Criticality as the subject of regulations

Favourably accepted regulations for the activities of the Pontenossa site on behalf of the appointed authorities are to do with plant technology, actions taken to protect the environment and landscape and organizational and management aspects (Rf. 16, 24).

In november 2010 Pontenossa presented the final report on biomonitoring activities carried out over a large area (25 km^2), with the production site at the centre. The territory under study is very varied, including built up areas, wooded hillsides, and mountain areas. Since September 2010, as part of the production process, the cristalization plant has been operative with the aim of partially removing chlorides from the Waelz oxide cleaning water. In 2008 and 2011 phonometric surveys were conducted. Since 2005 the settling of the Val Rogno diposal site has been monitored. Since april 2008 (according to procedure SG 30) metals have been monitored (zinc, lead, cadmium, selenium,) and also chlorides in discharged water; the results of these surveys are periodically included in the A.I.D.A. application program and managed by ARPA Lombardia. Furthermore, projects to strengthen the existing filter for the installation of a depuration plant for hydrogen oxide on the main atmospheric emissions are active. However, research to recuperate thermal energy from the post-combustion plant are still underway.

Criticality present in the latest authoritative provisions (AIA n. 10115/2010) relate to spreading emissions, disposal systems and water.

10.1.1. Development of spreading emissions

La Pontenossa S.p.A. is required to:

- Apply revision procedure SG 08 currently in force with more detailed information regarding criteria used to identify and manage irregularities especially those linked to the formation of deposits;
- Generally review management procedures and register irregularities and inform town councils in the area and ARPA within 24 hours of discovery.

The surface of the suction hood in the area where waelz slags are disposed has been increased in order to contain spreading emissions as much as possible (especially vapour) following fallout of waste material from the furnace and the immediate cooling of the water.

10.1.2. Disposal systems

For all disposal systems regarding emissions into the atmosphere, control systems have been put in place as required by the regional standards in force.

10.1.3. Water

Pontenossa S.p.A., in collaboration with the University of Bologna, carries out annual inspections of fish stocks and macrovertebrates in the Riso torrent together with chemical tests. As mentioned before, during 2012 from the company disposal site to confluence of the river Serio, a satisfactory recovery in terms of water quality has been noted for macrovertebrate stocks of ecological importance and the reappearance of trout in large numbers. As regards metals, values recorded downriver from the company dump have been found to be far inferior to those established by law.

Since 2011, the Company has further implemented a refluent water cleansing system with the addition of other specific reactives aimed at reducing the flow of heavy metals (lead in particular) emitted daily in the C.I.S. (Riso torrent).

For accident risks and management of emergencies, what still needs to be done is to provide the necessary requirements for activities running average fire risks. Given the nature, volume and collocation of materials used in Pontenossa a suitable fire risk system has been installed able to limit the risk and spread of fire, taking into account also the agricultural and wooded aspects of the area next to the plant.

10.2. The findings of local movements and associations

Observations made by the public and environmental associations (particularly Legambiente) relate to problems connected to the activities of Pontenossa.

Matters raised by the media, internet or other means of communication refer to (i) the stability of the disposal site, (ii) failure to use the best technology to recuperate zinc from steel work fumes, (iii) the right to “claim damages or restore health to the environment” (in the form of actions to restore places, clean and maintain woods and increase renewable energy) in relation to the economic advantages that the Val Rogno disposal site provides for the company, (iv) failure to keep the 200 jobs needed because of increased production, (v) environmental impact caused by emissions into the atmosphere, (vi) criticality linked to accidents (e.g. refractory collapse) or malfunctioning (e.g. filter malfunction), leading to the uncontrolled escape of dust and harmful gases, (vii) workers’ health risks and risks for the local population (viii) increased motor vehicle traffic due toplant activity and the enlargement of the disposal site; (ix) shortage of information to the public from Pontenossa and control boards.

As far as the diposal site is concerned, associations complain that it doesn't collect inert waste, as it should, but especially dangerous waste products. This is claimed to be because the company doesn't use the best available technology for the recovery of zinc and steel work dust. Putting outgoing waste products from the Waelz process into the disposal site would not be the most environmentally sustainable technical solution as it would be possible to generate inert slags with no presence of heavy metal after depuration.

The White Paper goes into some of these matters more deeply while another source of information are the laws and related regulations established by appointed authorities. As an example, Pontenossa has been authorized by the Lombardy Region to set up a experimental plant to treat decadent waste from the Waelz furnace that operates in the site. Other aspects (e.g. excellent technology to recycle zinc and reduce emissions) have not been discussed in detail in the Document as they don't come under the writer's field of knowledge.

There is no doubt that Pontenossa is taking necessary action to deal with issues of security regarding the surrounding territory and liabilities due to any pollution caused by processes used in production. However, any remarks or observations made by the public and various associations in relation to environmental changes linked to production need to be taken into consideration by the company as a starting point for open and transparent discussion with all those involved. An effective tool would be regular communication with the public as mentioned before.

11. RECOMMENDATIONS, AREAS OF IMPROVEMENT

11.1. Company policy regarding the environment and sustainable development

The innovative policies that the company has adopted in terms of environment and sustainability, need to be put into actual practice. (Ref. 54-56). They are distant from the formal bureaucratic vision that is often found in management systems for the environment, health and safety where prevention of industrial risk is merely pronounced in its cultural aspects and does not go beyond a routine list of laws, regulations and tecnical standards to be included in registers or bill books. The issue only takes on significance for the company when social problems or legal controversies arise or situations that make interesting news stories for the press.

In the management system proposed by Pontenossa there is undoubtedly a “dynamic” and culturally modern vision that goes beyond the formal aspect of conformity to standards. This is why the system should be given the same importance in its implementation as announced objectives.

For example, the degree of effectiveness that corrective or improved interventions have had or could have in reducing criticality or environmental pressires should be systematically analysed and measured.

An important priority would be to measure the distance from legal standard limits and identify conformity indicators based on the existing gap between company data and established limits. Thus going beyond the limited assessment of not surpassing set limits as the most important criteria to consider. (Ref. 87, 88). It would also be useful to thoroughly analyze work models connected to company activities and accepted regulations. This phase is often limited to showing adopted procedures without fully understanding the link between company work models and environmental aspects.

A methodical approach like this would certainly be an effective contribution to limiting industrial risks and a highly effective way of showing the public that the aims of the company are not merely concerned with conformity to legal standards.

11.2. Technological, organizational and managerial aspects

Regulations drawn up in the AIA Regional Decree 10115/2010 have to be fully adhered to, particularly in regard to (i) reducing the amount of waste products to a minimum, (ii) optimizing storage systems into single categories (Ref. 16, p. 81-91), (iii) reducing the development of emissions during storage and transportation of dust like materials used inside the site, (iv) avoid washing out contaminated water following contact with slags in the plant awaiting measurment procedures (possibile in the case of climatic events), (v) ensure the practice of management procedures and the timely notification of any irregularities and the limitation of spreading emissions such as those that can be released after a fallout from the furnace inside the extinguishing and cooling basin.

Procedures need to be developed and situations identified to face climatic problems such as ice and snow which make transport of waste to the disposal site difficult, if not temporarily impossibile and this results in excessively long periods of storage time.

Considering the regulations laid down by the authorities, the company has planned numerous corrective measures and improvements which are already operative.

Full action should be taken regarding projects to ensure that the best available technology is applied to the production process and waste disposal.

Available data shows that emission values of polluting substances are well below legal limits. The company, in order to be coherent with its own environmental policies, should aim to ensure continuous improvement to environmental results and further reduce polluting emissions. This would be seen as prudent and responsible behavior given also that the threshold effect of some pollutants linked to the company's production activities have not been declared as certain (e.g. PM2.5). Situations which lead to an increase in pollution, however modest, should be considered as areas of improvement and should always be managed together with measures of mitigation (Ref. 19, 20).

As far as the disposal site is concerned, the company has improved impermeability thus reducing any infiltrations (Ref. 16). With the planned enlargement monitoring regulations have to be followed both during the cultivating phase and during the recovery and post-management phase. Monitoring has to cover the main part of the disposal area (inclinometric measurements, extensimatric measurements, total station, etc) and include qualitative and quantitative checks on the environmental matrices involved in the enlargement. Therefore the required checks on the quality of water ways and the water of the Riso and Rogno torrents are very important. Piezometric recordings and capacity measurements are taken to check for the absence of contamination of surface and underground water even downstream of the disposal area. Monitoring data has to be made available to the public through the local town councils (Ref. 23).

Hopefully, in time, the company will manage to develop technology that enables recycling of waste and the conversion of the disposal site into "reserves of retrievable resources". Nowadays, at an international level, scientific commitment in the field of innovative environmental technology is constantly on the rise to find solutions that are not available today.

Improvement programs for the organizational management of certain aspects will be carried forward such as shutting down and reactivating demolition plants during maintenance or accidental breakdowns, necessary measures to be taken in case of damage caused to the environment (Ref. 6), updating of safety sheets (particularly regarding exposure and the toxic and eco toxic nature of the plant's substances), checking the effectiveness of emergency plans available for the management of accidents.

11.3. Territory, landscape and water resources

Recent company action (large scale planting and reforestation) meet the requirements of the regional and provincial Landscape Projects regarding the Riso Valley and Rogno Torrent. The aim is to safeguard the area around the plant and the disposal site which is potentially susceptible to degradable phenomena. Some of the interventions required by the reforestation program were already carried out in 2003 and 2004 on about 4 hectares of land owned by Pontenossa and Premolo town council. The reforestation program also includes more western areas, a further 10 hectares in Gorno (to do this the company is still waiting for authorization from Gorno council). The VIA Regional Decree of 2009 (Ref. 23) requires that these interventions are carried out to favour the development over time of a surface eco system which will be as natural as possible and able to host local fauna and represent a good level of biodiversity.

From a landscape view point the most qualifying element has been the recovery of the Rogno Torrent watercourse (april 2012), which gave the valley back its charateristic morphology. At On a level with the Riso torrent, along the main SP 46 road a wall has been built to defend the river bank and also a pedestrian area on the side of the road which used to be subject to erosion after flooding.

As for fish stocks, company policy should be based on the principles expressed in the European Water Document approved by the European Council on 6 may 1986 in Strasburg.

It states that the preservation of fish stocks must take into account that (i) the availablity of soft water is not inexhaustable, (ii) altering the quality of water is harmful to man and all creatures that depend on it, (iii) water quality must be good enough to satisfy required needs and above all the needs of public health. Water should be used to save and renew resources and shouldn’t endanger fish stocks, environmental habitats, agricolture, fauna and acquatic flora, geomorphologic processes and hydrologic balance.

In line with these priciples, the company’s Document of Environmental Policy (Ref. 54) has aimed to improve protection of water to ensure that fish that could be affected by the plant and disposal site (Riso and Rogno torrents) remain healthy. The aim is based on the capacity of fish to maintain their natural processes of self clearing and to defend different types of animal and vegetable species.
In this context various actions are taking place in order to (i) ensure regular chemical and biological monitoring of torrent water upstream and downstream of the plant disposal site, (ii) ensure that the value limits established by D.Lgs 152/06 are repected, (iii) define terms of transmission of data to the Province of Bergamo and ARPA regarding the capacity of the Riso torrent and water discharged from the company depuration plant, (iv) define cases and situations (e.g. capacity of Riso torrent, level of river Serio) when the hydroelectric power station has to be interrupted, (v) Carry out programs of a chemical nature to assess the varying concentrations of heavy metals (cadmium, chrome, lead, nickel and mercury) and the upstream and downstream conductivity of company waste disposal.

The discharged water contains concentrations of chlorides characteristic of this kind of manufacturing (waelz oxide washing). It is therefore necessary to do constant accurate monitoring of discharged water on a regular basis combined with the the correct functioning of the crystalization plant.

It is important that the company continues its monitoring studies of metals found in the soil and in vegetable species for a deeper assessment of ecological and eco toxic plants (ref. 11). Monitoring of metals (and other types of chemical agents, e.g. persistant organic pollutants) should be extended to more vegetable species including those that are edible and those grown specially because they are considered sensitive to pollutants and their varying levels of concentration.

According to regulations in the VIA Regional Decree of 2009 (Ref. 23), monitoring of vegetable species should also be done in areas near the Val Rogno disposal site and check for the spontaneaous appearance of exotic species that could find “fertile ground in which to take root as a result of ecological changes.

In completing the above mentioned studies, the company can make the most of the internal Chemical Lab which is already being used to satisfy the analytical needs in the production of Waelz oxide and the disposal of slags from the plant into the dump.

11.4. Monitoring air quality

Ministerial Decree VIA of 2005 (Ref. 24) and successive AIA Regional Decrees, require the contant monitoring of total organic carbon and total capacity linked to the main path of atmospheric emissions from the waelz plant. Continuous collection of environmental data should be the fulcrum of a “safeguard system” able to reveal instantly any irregularities that need contrasting measures to be taken against pollution.

In compliance with the regulations set out in the AIA Regional Decree 2010, regular air quality monitoring programs are under way in the area around the plant and are repeated at least once a year. Recently, monitoring od dust has been extended to the issue “inhalable” (PM2.5).

It is essential that the company defines internal value targets for emission limits and exposure in the work place of chemical pollutants in accordance with the regulations established by the European Union to control atmospheric pollution (Directive 2008/50/EC). Rather than the “safety standards” not based on scientific certainty, air quality parameters need to be considered that are realistic and objectively reachable and take into account past averages and mitigation aims related to pollution.

In view of this, the company should establish “internal regulations” and emission limits that are even stricter than the official ones, if these are coherent with technological equipment and proposed aims of sustainability.

The monitoring network should be strengthened with a greater chanelling of checking systems and control units installed to measure the fallout of pollutans released from the plant. It would also be useful to gather information on motor traffic pollution.

11.5.Noise pollution

Regulations set out in the AIA Regional Decree 2010 (Ref. 16) require that the company carries out noise recording programs every three years around the perimeters of the plant and near the main receptors in agreement with Ponte Nossa town Council and ARPA, thus ensuring respect of emission limits and noise immission. The company is further expected to show monitoring plans and present data regarding noise pollution tests (Ref. 16, p. 81).

11.6. Materials containing asbestos

Materials containing asbestos inside the plant have been removed over the last few years except for a warehouse named ex polvox which the company is expecting to get rid of by the end of 2013.

Removal of products made of asbestos were carried out following the recommendations of the ASL health office regarding specific work plans presented for this purpose.
A survey of fibre dispered in air conducted in 2007 recorded a concentration of < 1 fibre/litre.

11.7. Worker health surveillance

It is important to maintain the good current levels of clinical and lab studies during the task of worker health surveillance.

In order to maintain the hygienic and environmental conditions inside the site, regular environmental monitoring of chemical pollutants must be carried out with the same criteria and objectives as used in previous surveys (Ref. 25). The need for more channeled monitoring comes from the necessity to keep dust levels and exposure to metals in the work place under control, especially lead. The usual biological surveys to check for any sub clinical effects of exposure to metals should be maintained and it should be kept in mind that productive processes put workers in contact with metalic agents (lead and cadmium) both of which are known to have negative effects on the kidneys (Ref. 27).

Recently (D.M. 9 July 2012) the Ministry of Health redefined the contents of Attachments 3A and 3B of the D.Lgs. n. 81/2008 and the minimum data that has to be included by a qualified doctor regarding a worker’s suitability for a certain job. The same law demands annual communication to the Local Health Office (ASL) of collected data and workers’ risks. Minimum information to be included is indicated in the health and risks file. Apart from the data strictly regarding health and risks (prevention check ups, successive checks, case history, risk factors with precise individual levels of exposure in cases provided for by by the laws in force, etc.), the file must also contain data about the department, the specific job, and a historic profile of the employee’s working life.

The decree sets a transitory phase of 12 months (i.e. until 25 August 2013) so as to allow for an initial experimental period and assessment of the expected results (see Ref. 90 for a more detailed analysis).

The company is also expected to adopt internal procedures and keep registers to ensure that the health of workers employed by sub contractors operating inside the plant, is regularly checked. In many industrial situations, sub contracting has become one of the sectors with the highest level of criticality and greatest risk of accidents at work. Next to the traditional safety rules between firms the law adds a new condition which includes safety on construction sites. There are two distinct organizational safety models, one regarding inter-company risks, linked to specific individual risks pertaining to the work carried out by the firm within its own site and the other refers to risks of accidents on construction sites which involve the direct convergency of different jobs within the plant area and which therefore need effective coordination.

In Pontenossa this aspect is quite marginal and involves a limited number of workers but has to be accounted for in the company management system in the light of the laws in force relative to these issues (Heading I of D.Lgs n. 81/2008 and Heading IV, Paragraph I of this Decree).

11.8. Management of emergencies

As already discussed, Pontenossa set up a Safety Management System to prevent serious accidents. Internal alert and reponse to emergencies procedures undergo periodic tests. Periodic accident drills and simulations should also be planned involing public services of prompt intervention (fire service, 118, hospital casualty department, poison information centre), following the indications set out today for aid intervention in major industrial accidents (Ref. 109).

Following an up-date of projects relative to fire prevention, currently underway, the company should make a priority of obtaining the Fire Prevention Certificate in a reasonable period of time.

11.9. Economic and social aspects and relations with the local community

The presence of the Pontenossa production site undoubtedly offers advantages that benefit the local community such as jobs, services, support for cultural and educational activites, economic compensation, etc. These benefits should be assessed in terms of balance when considering also the negative prospects for the environment, landscape, and well-being of the population (pollution of the environment, waste production, consumption of resources like water and woodland, effects on biodiversity, induced traffic, hindering tourist development, etc.).

In view of the various company projects in the pipeline, it would be useful to consider putting into action an integrated economic and social analysis of the Pontenossa site, in order to define the level of global sustainability in the area using strictly scientific methods given the specific territorial context. Such a proposal is also linked to the fact that the local community and citizen associations have often expressed criticism towards Pontenossa S.p.A. through the press and public demonstrations complaining about the lack of information about the impact from site activities.

Communication problems may seem of little importance at a local level but should not be separate from the greater and more complex problem of relations between enterprise and the community of citizens in areas where you find industrial plants that cause pollution (Ref. 105, 112, 114).

It is not uncommon to observe how the resident population in industrialised areas express fears and anxiety for the effects of environmental pollution which lead to psychological reactions based on the insecutity and uncertainty of their state of well-being. Company management sometimes underestimates these reactions especially when there is objevtive proof that showing that the production process has negligible impact on the environment and on the health of the population and when the plant technology used is designed to keep pollution levels within tolerated values. However, this situation shows that when there is a lack of communication policy, these requisites are not sufficient to guarantee the psychological health of the population and avoid collective stress and unease from developing due to the subjective perception of living in an unhealthy environment (Ref. 113).

The situation obviously has more complex origins. Industrialisation has bivalent impact and it is inevitabile that imbalances are created linked to diverging interests and contrasing visions in the social context of the area. It is of little wonder therefore, that the presence of a large industrial complex can create contrasts at a local level even when strict assessments of impact meet the requirements of the law. However, these conflictual situations are often nourished by lack of communication and insufficient involvement of the public (Ref. 18). Sometimes conflictual situations don’t arise so much because of radical contrasts to industrial activity but rather to citizens feeling emarginated from issues regarding sustainable choices and behaviour.

A company’s activity can consider itself sustainable if it is regulated by management systems that enable open communication with the outside world regarding environmental performance (Ref. 7). It would be necessary to adopt methods that would make the company’s environmental policy public and shows its responsibility towards the territory it finds itself in. Strong commitment to correct and responsible communication would help stimulate cultural cooperation and help overcome the idea that development is in contrast with respect for the environment and the protection of citizens’ health and rights (Ref. 21).

It should also be remembered that with Law 108 of 16 march 2001 (G. U. n. 85 of 11 april 2001 – Ordinary Supplement n. 80), Italy ratified the Aarhus Convension which governs public access to information, participation in decisional processes and justice where environmental are concerned. Access to environmental information is a right bestowed on citizens and important social and environmental associations. Citizen involvement means taking part in informed choices and therefore access to data, access to the necessary elements for assessment of plans and projects in terms of their impact on the environment, health and also on the economy and on social attitudes. Taking into consideration the point where individual rights and the environment converge, with the Aarhus Convention, three priciples and three citizen's rights have been clearly established: environmental information, participation in decision making and claiming justice.

Citizens must have effective opportunities to partecipate and be able to express observations and opinions when all options are open to dicussion and before plans and projects are put into action. Public right to participation in decision making for environmental issues has been further enforced by Directive 2003/35/EC.

Pontenossa S.p.A. Code of Ethics recognizes the ethical principles of institutional communication and to external relations inspired by the principles of honesty, transparency and constructive collaboration of all parties involved. This is reinforced by the Environmental Policy Document (Ref. 54) where the company's commitment to "redefine its own policy in relation to information collected from all those who work for the company or on their behalf and on the behalf of all external parties involved".

It is therefore important that communication with the outside world becomes a strategic instrument that favours knowledge of company policy, plans and projects carried out with correct and transparent criteria. A first step in this direction is the creation of the company web site operative from February 2012 with the aim to comunicate, ensure the transparancy of processes and share information and the evolution of company activities with the local community, the territory and all web users.

In view of this prospect, concrete action could be taken to publish a periodical Report of Sustainability by which Pontenossa can inform everyone about what has been done and what is going to be done in the future in terms of environmental improvement and sustainable global development.

11.10. Code of volontary conduct

Pontenossa S.p.A. obtained the UNI ISO 9001:2008 certification in 2012 (Quality Management, already in use since 1994 as a Guarantee for Quality) and in 2012 obtained the UNI EN ISO 14001:2004 certification (Management of the Environment), relating to plant activities and those of the hydro-electric power station in the Costone area of Casnigo (BG). The production of Waelz oxide by means of the recovery of zinc from industrial waste using the Waelz process, disposal of decadent waste from the process and production of own hydro-electric energy have all been certified. Safety management systems and health in the work place are under way and are can be certified according to standard OHSAS 18001 (Ref. 16).

In the Environmental Policy Documents (Ref. 54) and Quality Policy Documents (Ref. 80) the company commits to maintaining certification of its own environmental management systems as an integral part of the environmental management system and the adoption of volontary standards as an instrument chosen to guarantee systematic, objective and periodic assessment of its performance and report on improvements in performance and ensure the sustainability of the plant. This gathers importance also under the aspects of civil and penal responsability and administrative responsability according to D.Lgs. 231/2001. Extending the responsability of the authorities to specific environmental crimes introduced by D.Lgs n. 121/2011 has not indicated specific criteria for drawing up organisation and management models. However, the requirements relative to environmental management systems that keep to methods of volontary certification as expressed by recognized standards (standard ISO 14001 and regulation EMAS) complete all prerogatives included in organization model 231 (Ref. 87).

In view of this, it would be important to begin a program for certification that conforms with the requirements of the International Standard SA8000 (Management System for Social Responsability). This system commits to integrating social, environmental and economic policies into the strategies of company management and developing a “enterprise of citizenship” based on assets of a natural, social, human and economic nature.

Prof. Luigi Manzo Pavia, May 2013

The author of the White Paper on the Pontenossa S.p.A. Industrial Site is a professor in the Departments of Clinical and Surgical Science, Diagnostics and Pediatrics at Pavia University. He is head of official studies in Medical Toxicology and Urgent Clinical Toxicology on the degree course of Medicine and Surgery. He teaches in Schools for Medical Specialisation in the work place, Internal Medicine, Urgent Medicine and Ematology.
He directs the School for Specialisation in Medical Toxicology and the Level II Master Degree "Assessment and Control of Toxicological Risks from Environmental Pollutants".
He is head of the Course in Biomedical Science at the Superior University School of Pavia (IUSS)
He directs the Deparment of Environmental Medicine and the National Centre of Toxicology Information at the IRCCS Salvatore Maugeri Foundation.

This Document was produced thanks also to the collaboration of Dr. Sabrina Spaghi, Department of Political and Social Sciences, Pavia University and Sabrina Spaghi and Mrs. Margherita Tealdi, Toxicological Services, IRCCS Salvatore Maugeri Foundation.

12. REFERENCES

1. Spaghi S, Manzo L. *Impianti a Biomasse e Salute Pubblica. Linee di Indirizzo per le Politiche Energetiche nella Provincia di Pavia (Biomass Systems and Public Health. Energy Policy guidelines in the Province of Pavia),* Province of Pavia, Environment Council Department, Pavia, March 2011.
2. Manzo L, Spaghi S, Baldiraghi R, Invernizzi R. Human health impact of biomass-fuelled power plants. Research trends and risk management approaches. *World Conference of Environmental Biotechnology*, Dalian, China 19-21 October 2011, p. 46
3. Brownson RC, Fieldling JE, Maylahn CM. Evidence-Based Public Health: A Fundamental Concept for Public Health Practice. *Ann Rev Public Health* 30: 173-201 (2009).
4. ISPRA (Higher Institute for Environment Protection and Research) & ARPA-APPA (Regional Agency for Prevention and Environment - Province Agency for Prevention and Environment). *Linee Guida per la Redazione della Relazione sullo Stato dell'Ambiente di Livello Territoriale (Guide Lines for the Editing of the Report on the Condition of the Environment at Local Level).* Document n. 05/11, 25 May 2011
5. Pontenossa S.p.A. *Storia Produttiva dello Stabilimento Pontenossa (History of Production in the Pontenossa Power Station),* May 2012.
6. Pontenossa S.p.A. *Analisi Ambientale Iniziale sull'insediamento industriale Pontenossa (Opening Environmental Analysis of the Pontenossa industrial settlement)* , 27 June 2012.
7. Holling CS. *Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations*. Scientific background paper, World Summit on Sustainable Development; The Environmental Advisory Council to the Swedish Government, 2002.
8. Italian Ministries of Labor, of Health and of Social Policies. *Rapporto del Progetto EPIAIR "Inquinamento atmosferico e Salute: Sorveglianza Epidemiologica ed Interventi di Prevenzione (Report of the EPIAIR Project "Air Pollution and Health: Epidemiological Surveillance and Preventive Actions),* 2009.
9. Pope CA, Ezzati M, Dockery DW. Fine-particulate air pollution and life expectancy in the United States. *New Engl J Med* 360: 376-386 (2009).
10. Lippman M, Schlesinger RB. Toxicological bases for the setting of health-related air pollution standards. *Annu Rev Public Health* 2: 309-333 (2000).
11. Baccarelli A, Martinella I, Zanobetto A, Grillo P, Hou L-F, Bertazzi PA, Mannucci PM, Schwartz J. Potential health risks of air pollution beyond triggering acute cardiopulmonary events. *Arch Int Med* 168: 920-927 (2008).
12. Jarrett M. Burnett RT, Pope CA, Ito K, Thurston G, Krewski D, Shi Y, Calle E, Thun M. Long-term ozone exposure and mortality. *New Engl J Med* 360: 1085-1095 (2009).

13. Mauderly JL, Samet JM. Is there evidence for synergy among air pollutants in causing health effects ? *Environ Health Perspect* 117: 1-6 (2009).
14. Lewtas J. Air pollution combustion emissions. Characterization of causative agents and mechanisms associated with cancer, reproductive, and cardiovascular effects. *Mutat Res* 636: 95-133 (2007).
15. Jung MC, Thornton I. Heavy metal contamination of soils and plants in the vicinity of a lead-zinc mine, Korea. *Applied Geochemistry,* 11: 53-59 (1996).
16. Regional AIA (Integrated Environment Authorization) Decree n. 10115/2010: Amendment and integration to the AIA Decree n. 3403, 04/04/2007 and further amendments and/or integrations concerning "Integrated Environment Authorization (IPPC) in compliance to the Legislative Decree n. 59, 18 February 2005, issued for Pontenossa S.p.A., with legal headquarters in Milan, Via Vincenzo Viviani, 8, for the power station in Ponte Nossa (BG) in via Prealpina Orobica n. 60. Region Lombardy, 7 October.
17. European Environmental Agency. *Ensuring Quality of Life in Europe's Cities and Towns*. EEA Report n. 5/2009. Copenhagen 2009, p. 1-109.
18. Upreti BR. Conflict over biomass energy development in the United Kingdom. Some observations and lessons from England and Wales. *Energy Policy* 32: 785-8000 (2004).
19. Brunekreef B, Holgate ST. Air pollution and health. *Lancet*, 360: 1233-1242 (2002).
20. Cakmak S, Burnett RT, Krewski D. Methods for detecting and estimating population threshold concentrations for air pollution-related mortality with exposure measurement error. *Risk Analysis* 19: 487-496 (1999).
21. Cancila E, Tollari F, Ottolenghi M. La partecipazione per gestire il conflitto ambientale (Taking part in managing the environmental conflict. *Ecoscienza*, ARPA (Regional Agency for Prevention and Environment) Emilia Romagna, 2: 84-85 (2010).
22. Local Healthcare Company Bergamo. *Epidemiologia dei Tumori - Distretto Socio-Sanitario Valle Seriana (Tumor Epidemiology – Social-Healthcare District Seriana Valley*, ASL (Local Healthcare Company) District Management , Document n. 944.
23. Regional VIA (Evaluation of the Impact on the Environment) Decree n. 7023/2009: Enlargement Project for the Special Waste Disposal Site of Val Rogno, in the Towns of Gorno and Premolo (Bergamo). Proponent Pontenossa S.p.A. Environmental Compatibility Pronouncement in compliance to Legislative Decree n. 152/06. "Region Lombardy, General Management for Territory and Town-planning, 8 July 2009.
24. Decree issued by the Italian Ministry for the Environment and Safeguard of the Territory, DSA (Environment Safeguard Department) 2005/00925. Pronouncement in favor of the environmental compatibility regarding the project submitted by the Company Pontenossa S.p.A. 12.09.2005, concerning the productive capacity enlargement of the system for special dangerous and non-dangerous waste treatment located in the municipality of Ponte Nossa (BG).
25. Cottica D. Pontenossa S.p.A. *Indagine ambientale per la misura degli agenti chimici ai sensi del D.Lgs. 81/08 s.m.i.* (*Environmental investigation concerning the amount of chemical agents in compliance with the Legislative*

Decree 81/08 and further amendments and/or integrations), Salvatore Maugeri Foundation, Pavia 2001.

26. Rebba A. *Pontenossa S.p.A. Annual Sanitary Report 2011*. Ponte Nossa, 19 January 2012.
27. Shelley R. Associations of multiple metals with kidney outcomes in lead workers. *Occup Environ Med* 69: 727-735 (2012).
28. Potocnik J. Da rifiuto a risorsa per l'ambiente e l'economia (From waste to resource for the environment and the economy). *Ecoscienza, ARPA (Regional Agency for Prevention and Environment) Emilia Romagna* 4: 13-15 (2013).
29. Jensen C.W. *Il Processo Waelz (The Waelz Process)*, Pontenossa power station, 13 June 1985.
30. Brunekreef B. Health effects of air pollution observed in cohort studies in Europe. *J Exp Sci Environ Epidemiol*, 17: 61-65 (2007).
31. Dockery DW, Stone PH. Cardiovascular risks from fine particulate air pollution. *New Engl J Med*, 356: 511-513 (2007).
32. Pope CA, Ezzati M, Dockery DW. Fine-particulate air pollution and life expectancy in the United States. *New Engl J Med*, 360: 376-386 (2009).
33. Nawrot TS, Perez L, Kunzli N, Munters E, Nemery B. Public health importance of triggers on myocardial infarction: a comparative risk assessment. *Lancet*, 377(9767): 732-40 (2011).
34. Forastiere F. *Gli effetti dell'inquinamento atmosferico sulla salute (Air pollution effects on health)*, A.S.L. (Local Healthcare Comapany) Epidemiology department Rome E, Rome, 2002.
35. Lippman M, Schlesinger RB. Toxicological bases for the setting of health-related air pollution standards. *Ann Rev Public Health*, 2: 309-333 (2000).
36. Ackerman-Liebrich U, Leuenberger P, Schwartz J. Lung function and long term exposure to air pollutants in Switzerland. Study on air pollution and lung diseases in adults. *Am J Respir Crit Care Med*, 155: 122-129 (1997).
37. World Health Organization. *Health Impact Assessment: main concepts and suggested approach*. European Centre for Health Policy, Copenhagen: WHO Regional Office for Europe, 1999.
38. Muller NZ, Mendelsohn R. Measuring the damages of air pollution in the United States. *J Environ Economics Management* 54: 1-14 (2007).
39. Koop G, Tole L. Measuring the health effects of air pollution: to what extent can we really say that people are dying from bad air? *J Environ Economics Management* 47: 30-54 (2004).
40. NAESS O, NAFSTAD P, AAMODT G, CLAUSSEN B, ROSLAND P. Relation between concentration of air pollution and cause-specific mortality: four-year exposures to nitrogen dioxide and particulate matter pollutants in 470 neighborhoods in Oslo. Norway. *Am J Epidemiol*, 165: 435-443 (2007).
41. Kunzli N, Kaiser R, Medina S, Studnick M, Chanel O, Fillinger P, Herry M, Horak F, Puybonnieux-Texier V, Quenél P, Schneider J, Seethaler R, Vergnaud JC, Sommer H. Public-health impact of outdoor and traffic-related air pollution: A European Assessment. *Lancet*, 356: 795-801 (2000).
42. Breitner S, Stolzel M, Cyrys J, Pitz M, Wolke G, Kreyling W, Kukenhoff H, Heinrich J, Wichmann H-E, Peters A. Short-term mortality during a decade of improved air quality in Erfurt, Germany. *Environ Health Perspect*, 117: 448-454 (2009).

43. WHO. *Air Quality Guidelines for Europe. Second Edition.* World Health Organisation Regional Publications. European Series n° 91, 2000.
44. Baccarelli A, Martinella I, Zanobetto A, Grillo P, Hou L-F, Bertazzi PA, Mannucci PM, Schwartz J. Potential health risks of air pollution beyond triggering acute cardiopulmonary events. *Arch Int Med*, 168: 920-927 (2008).
45. Schwela D. Air pollution and health in urban areas. *Rev Environ Health*, 15: 13-42 (2000).
46. Knol AB, De Hartog JJ, Boogaard H, Slottje P, Van der Sluijs JP, Lebret E, Cassee FR, Wardekker JA, Ayres JG, Borm PJ, Brunekreef B, Donaldson K, Forastiere F, Holgate ST, Kreyling WG, Nemery B, Pekkanen J, Stone V, Wickmann HE, Hoek G. Expert elicitation on ultrafine particles: likelihood of health effects and causal pathways. *Particle and Fibre Toxicology*, 6: 19 (2009).
47. Quincey P, Butterfield D. Ambient air particulate matter PM10 and PM2.5: developments in European measurement methods and legislation. *Biomarkers,* 14(S1): 34-38 (2009).
48. Mauderly JL, Samet JM. Is there evidence for synergy among air pollutants in causing health effects? *Environ Health Perspect*, 117: 1-6 (2009).
49. Last JA, Sun WM, Witschi H. Ozone, NO, and NO2: oxidant air pollutants and more. *Environ Health Perspect*, 102 (Suppl 10): 179-184 (1994).
50. Bhatia R, Wernham A. Integrating human health into environmental impact assessment: an unrealized opportunity for environmental health and justice. *Environ Health Perspect* 116: 991-1000 (2008).
51. Melotti P. et al. *Monitoraggio di popolamenti ittici e di macroinvertebrati nel torrente Riso (Minitoring ichthyc and macroinvertebrate populations in the Riso stream*, University of Bologna, Research Centre for Technology and Hygiene of Small Species Intensive Livestocks, December 2011.
52. Giugliano M, Grosso M. *Analisi dei dati di emissione e di qualità dell'aria nella zona dello Stabilimento Pontenossa (Emission data and air quality analysis on the Pontenossa Power Station area),* Hydraulic, Environmental, Road Infrastructures and Survey Engineering Department, Polytechnic of Milan, 2003.
53. Giugliano M, Tardivo R. Pontenossa S.p.A. *L'effetto della tecnica di trasporto e movimentazione dei materiali sulla presenza di polveri in atmosfera (Effect of the transport and handling of goods method on the presence of fine particulates in the air*, Hydraulic, Environmental, Road Infrastructures and Survey Engineering Department, Polytechnic of Milan, 2003.
54. Pontenossa S.p.A. *Environment Policy Document*, 21 December 2011.
55. Triantafillidis JK, Niasoulas G, Kosmidis PA. Colorectal cancer and inflammatory bowel disease: epidemiology, risk factors, mechanisms of carcinogenesis and prevention strategies. *Anticancer Research* 29: 2727-2737 (2009).
56. Pontenossa S.p.A. *Relevant Accident Prevention Policy Document*, 18 January 2012.
57. Pontenossa S.p.A. *Safety Report in compliance with Article 8 of the Legislative Decree 334/99*, October 2011.
58. Janes H, Dominici F, Seger SL. Trends in air pollution and mortality. *Epidemiology* 18: 416-423 (2007).

59. G. Rivellini, E. Dolci: *Extended Area Bio-monitoring,* Arethusa, Curno (Bergamo), October 2010.
60. Pontenossa. *Personnel Training Plannning*. Year 2012, p. 1-9.
61. Pontenossa. *Training Procedure and Personnel Qualification,* 29.06.1012, p. 1-5.
62. TEI. *Test Report n. 960,* TEI Services and Environmental Consultancy for Businesses. Particulates in the emissions of E16, 21.09.2004.
63. Pontenossa S.p.A. *Model 231. Organization, Management and Control Model,* 18 September 2012.
64. Lamir. *Statistical analysis of the data on monitoring campaigns and linkage analysis regarding the emissions produced by the Company Pontenossa S.p.A.*, Environment Study Research Service, Mondavio (PU), 30 September 2010.
65. FEA Services. *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Location Premolo,* Solarolo, Ravenna, rel. n. 01/2010.
66. FEA Services. *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Location Ponte Nossa,* Solarolo, Ravenna, rel. n. 02/2010.
67. FEA Services. *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Location Gorno,* FEA Servizi, Solarolo, Ravenna, rel. n. 03/2010.
68. Lamir. *Statistical analysis on the 2010 monitoring campaign data and linkage analysis regarding the emissions produced by the Company Pontenossa S.p.A.*, Environment Study Research Service, Mondavio (PU), 24 August 2011.
69. FEA Services. *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Location Premolo,* Solarolo, Ravenna, rel. n. 02/2011.
70. FEA Services. *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Location Ponte Nossa,* Solarolo, Ravenna, rel. n. 03/2011.
71. FEA Services. *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Location Gorno,* Solarolo, Ravenna, rel. n. 04/2011.
72. Lamir. *Statistical analysis on the 2011 monitoring campaign data and linkage analysis regarding the emissions produced by the Company Pontenossa S.p.A.*, Environment Study Research Service, Mondavio (PU), 28 April 2012.
73. FEA Services, *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Location Gorno,* Solarolo, Ravenna, rel. n. 04/2012.
74. FEA Servizi. *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Location Premolo,* Solarolo, Ravenna, rel. n. 05/2012.
75. FEA Services. *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Location Ponte Nossa,* Solarolo, Ravenna, rel. n. 06/2012.
76. Lamir. *Statistical analysis on the 2012 monitoring campaign data and linkage analysis regarding the emissions produced by the Company Pontenossa S.p.A.*, Environment Study Research Service, Mondavio (PU), 15 October 2012.
77. FEA Servizi. *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Postazione Gorno,* Solarolo, Ravenna, rel. n. 21/2012.
78. FEA Servizi. *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Postazione Premolo,* Solarolo, Ravenna, rel. n. 22/2012
79. FEA Servizi. *Pontenossa S.p.A. Environment Monitoring. Atmosphere. Postazione Ponte Nossa,* Solarolo, Ravenna, rel. n. 23/2012.
80. Pontenossa S.p.A. *Quality Policy. Quality Handbook*, 30 September 2010.
81. Hazard Research Technology. *Pontenossa S.p.A. Power station in Ponte Nossa (Bergamo). Safety Report in compliance to Article 8 of the Legislative Decree*

n. 334/99 and further amendments and/or integrations, Osio Sotto (Bergamo), October 2011.

82. Italian Ministry for the Environment and Safeguard of the Territory and of the Sea. Project for the enlargement of the waste disposal site Category II type B in the Municipalities of Gorno and Premolo (Bergamo), site Valle Rogno. Submissioner Pontenossa S.p.A. – Evaluation of the compliance to precept n. 9 contained in the decree n. DEC/VIA/3055 of 9/06/1998. Protocol, DSA – 2007 – 0014676 of 23/05/2007.
83. SENTIERI (Paths). National Epidemiologic Study concerning Territories and Settlements Exposed to the Risk of Pollution. Epidemiologic evidence evaluation. *Epidemiologia e Prevenzione (Epidemiology and Prevntion)*, 34 (Suppl. 3), September-December 2010.
84. Baldacci S, Maio S, Viegi G. Air pollution and human health. *Epidemiologia e Prevenzione (Epidemiology and Prevention)*, 33: 1-72 (2009).
85. Danaei G, Van der Horn S, Lopez AD, Murray CJL, Ezzati M, Causes of cancer in the world: comparative risk assessment of nine behavioural and environmental risk factors. *Lancet*, 366: 1784-1793 (2005).
86. Gamble JF, Nicolich MJ, Boffetta P. Lung cancer and diesel exhaust: an updated critical review of the occupational epidemiology literature. *Crit Rev Toxicol*, 42: 549-598 (2012).
87. Iraldo F., 231 Models and environmental crimes: How to integrate thanks to SGA (Environment Integrated Management Systems)? *Ambiente e Sicurezza (Environment and Safety)*, p. 80-90, 10 April 2012.
88. Flores M. Law is a compromise. *Corriere della Sera*, 19 August 2012.
89. 9 July 2012 Decree of the Italian Ministry of Health. Content and modalities for the transmission of information concerning aggregated sanitary data and worker risk, in compliance to Article 40 of Legislative Decree n. 81/2008 on health and workplace safety safeguard, G.U. (Italian Official Gazette) n. 173, 26 July 2012.
90. Ferrari D. Sanitary Supervision Safeguard: new annexes 3A and 3B on directory and collective data. *Ambiente e Sicurezza (Environment and Safety)*, 18 September 2012.
91. European Environment Agency. *Revealing the costs of air pollution from industrial facilities in Europe*, Technical Report n. 15, 2011.
92. Michaud CM, Murray CJL, Bloom BR. Burden of disease - Implications for future research. *J Am Med Ass*, 285: 535-539 (2001).
93. Commission Regulation (CE) n. 1881/2006, 19 December 2006. Maximum content of certain pollutants in food products.
94. Scientific Committee on Food (2003) Opinion of the Scientific Committee on Food on the tolerable upper intake level of trivalent chromium. http://ec.europa.eu/food/fs/sc/scf/out197_en.pdf
95. Commission Directive 2008/100/CE, 28 October 2008. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:285:0009:0012:IT:PDF
96. Vedal S, Brauer M, White R, Petkau J. Air pollution and daily mortality with low levels of pollution. *Environ Health Perspect*, 111: 45-51 (2003).
97. Dominici F, Peng R, Bell ML, Pham L, Mc Dermott A, Zeger SL, Samet JM. Fine particulate air pollution and hospital admission for cardiovascular and respiratory diseases. *J Am Med Ass*, 295: 1127-1136 (2006).

98. Trosko JE, Upham BL. A paradigm shift is required for the risk assessment of potential human health after exposure to low chemical exposures: a response to the toxicity testing in the 21st century report. *Int J Toxicol* 29: 344-357 (2010).
99. European Environment Agency. Eleven Member States exceed air emission limits under LRTAP Convention. http://www.eea.europa.eu/highlights/eleven-member-states-exceed-air. Consultato il 2 marzo 2013.
100. Rabl A, Spadaro JV. Damages and costs of air pollution: an analysis of uncertainties. *Environment International*, 25: 29-46 (1999).
101. Berti G, Chiusolo M, Greghi D., EPIAIR (Epidemiological Surveillance and Preventive Actions) Project. Environmental indicators in 10 Italian cities (2001-2005): data for epidemiological surveillance relating to the quality of the air. *Epidemiologia e Prevenzione (Epidemiology and Prevention)* 33 (Suppl. 1): 13-26 (2009).
102. Cadum E, Berti G, Biggeri et al. EpiAir (Epidemiological Surveillance and Preventive Actions) results and national and international literature. *Epidemiologia e Prevenzione (Epidemiology and Prevention)* 33 (Suppl. 1): 113-119 (2009).
103. Stafoggia M, Faustini A, Rognoni M et al. Air pollution and mortality rate in 10 Italian cities: results from the EpiAir (Epidemiological Surveillance and Preventive Actions) Project. *Epidemiologia e Prevenzione (Epidemiology and Prevention)* 33 (Suppl. 1): 65-76 (2009).
104. Directive concerning arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in air environment. *European Parliament and Council Directive 2004/107/CE*, 15 December 2004.
105. Millennium Ecosystem Assessment. *Ecosystems and human well-being: A framework for assessment*, United Nations, New York, 2005.
106. Casella C, Garrone E, Gennaro V, Orengo MA, Puppo A, Stagnaro E. Health conditions of the general population living near a steel plant. *Epidemiol Prev*, 29: 77-96 (2005).
107. European Food Safety Authority (EFSA). Admissible dose of Cadmium in food, 20 March 2009. http://www.efsa.europa.eu/it/press/news/contam090320.htm. Consulted on 27 February 2013.
108. Bergamo Local Healthcare Company, *Health Prevention, Control and Promotion. Valle Seriana Superiore and Val di Scalve district branch, Summary Report 2011*, ASL (Local Healthcare Company) Bergamo Medical Prevention Department.
109. Locatelli C, Petrolini V, Butera R, Gandini C, Fasola D, Candura SM, Manzo L. *Le catastrofi tossicologiche: l'intervento sanitario (Toxicologic catastrophies: sanitary intervention)*, Springer, Milan, 2000, p. 169-180.
110. Italian Ministry for the Environment. Ministry Decree n. 471, 25 October 1999, n. 471. Regulation bearing criteria, procedures and modalities for security restoration, reclamation and environmental restoration in polluted sites in compliance to article 17 of the Legislative Decree n. 22, 5 February 1997, and further amendments and/or integrations. Italian Official Gazette n. 293, 15.12.1999.
111. Environmental Protection Agency, US EPA. *Guidance for developing ecological soil screening levels. OSWER Directive 9285-55*, Washington DC, November 2003.

112. Desaigues B, Ami D, Bartczak K, Braun-Kohlova M, Chilton S, Czajkowski M, Farreras V, et al. Economic valuation of air pollution mortality: A 9-country contingent valuation survey of value of a life year (VOLY). *Ecological Indicators* 11: 902-910 (2011).
113. Marques S, Lima ML. Living in grey areas: Industrial activity and psychological health. *J. Environ Psychol* 31: 314-322 (2011).
114. Elliott SJ, Cole DC, Krueger P, Voorberg N, Wakefield S. The power of perception: health risk attributed to air pollution in an urban industrial neighbourhood. *Risk Analysis*, 19: 621-634 (1999).
115. Garcia-Perez J, Lopez-Cima MF, Boldo E, Fernandez-Navarrro P, Aragones N, Pollàn M, Pérez-Gomez B, Lopez-Abente G. Leukemia-related mortality in towns lying in the vicinity of metal production and processing installations. *Environment International* 36: 746-753 (2010).
116. Gallagher RP, Threlfall WJ. Cancer mortality in metal workers. *Can Med Assoc J*, 129: 1191-1194 (1983).
117. Brekken A, Steinnes E. Seasonal concentrations of cadmium and zinc in native pasture plants: consequences for grazing animals. *Science of the Total Environment*, 326: 181-195 (2004).
118. Mingorance MD, Valdes B, Rossino Iliva S. Strategies of heavy metal uptake by plants growing under industrial emissions. *Environment International* 33: 514-529 (2007).
119. Field R.W. A review of residential radon case-control epidemiologic studies performer in the United States. *Reviews of Environmental Health* 16: 151-167 (2001).

	DISPOSITION	STATE	NOTES
1) Damage to the Environment			
a	Check that the Board of Directors on the Site is aware: - of the dispositions contained in the art 311,co.2 , Legislative Decree 152/06 (whoever …….may cause damage to the environment, by partially or totally altering, harming or destroying it, is compelled to restoring it to its previous condition and, if this may not be, to compensate the State for an *equivalent amount to the value of property*) of the duty of taking the necessary preventive measures within 24 hours in the case of an event that could *potentially* contaminate the site arises (art.242 co.1 of Legislative Decree n. 152/06) of the duty of *immediately* taking all the possible actions to keep under control and mitigate environmental damage when it may arise, moreover , the duty of taking the necessary measures to restore the previous condition in compliance with art.306 of Legislative Decree n. 152/06 (art.305 co.1 of Legislative Decree n. 152/06) of the dispositions in art. 257 co. 1 Legislative Decree. 152/06 (whoever may cause soil or subsoil, superficial or deep water pollution by exceeding "*risk threshold concentrations"* will be punished… unless the offender carries out the reclamation of the site in compliance with the project approved by the authorities…)		Note roles and responsibilities of the Board of Directors in the SGA (Environment management System) manual
b	Check with the person responsible, that he/she has knowledge of the content of art. 242 co 1 and of art. 304 co.2 of Legislative Decree n. 152/06: *"immediately inform"* the Authorities (Town Council, Province, Region, Prefect), according to the established modalities when a potentially contaminating event takes place on the site *"immediately inform"* the Town Council, the Province, the Region, the Prefect) and other Authorities involved whenever damage to the environment should arise and send a clain to the Ministry for the Environment. within and not over 30 days with the possible measures to be taken for restoring the environment to its previous condition (art.306 co.1 Legislative Decree n. 152/06)	C	AIA (Integrated Environment Authorization) regulations
c	*Check that certified absorbing material is available if there are lead batteries and/or electric forklifts (Ministry Decree n.20, 24/1/2011)*		
2) Building and enlargement plans			
	Check document evidence: building license *(or equivalent*)	C	Property of the Leasing Company, documents collected by the person responsible for property management
3) Frequently occupied buildings that have been certified as healthy environments			
	Check document evidence for *fitness for use / habitability*	C	Documents collected by the person responsible for property management. Fitness for use Certificate of Company warehouses, 27-2-1985. Building of

	DISPOSITION	STATE	NOTES
			offices prior to 1967.
4) Activities included in the list of unhealthy firms			
	Indicate AIA (Integrated Environment Authorization) and reference to the unhealthy firms category (articles 216 and 217 of Decree n. 1265/1934 included in Legislative Decree n. 59/2005)	C	In the AIA (Integrated Environment Authorization) Decree n.10115/10 such aspects are not handled
5) Evaluation of the Impact on the Environment			
	Check that the Organization has taken the measures that are necessary for evaluating whether its projects/programs are listed or not in the application field of the procedural rules for VIA (Evaluation of the Impact on the Environment) and/or VAS (Strategic Environmental Evaluation) (art.7 , Legislative Decree n. 4/2008*)*	C	Power station: VIA Ministry Decree DEC/DSA/2005/00925, 12-9-2005. Waste Disposal Area: Ministry VIA (Evaluation of the Impact on the Environment) DEC/VIA/3055, 10-6-1998; Regional VIA (Evaluation of the Impact on the Environment) for the waste disposal area enlargement Decree n. 8023, 8-7-2009
	Check management conditions in order to comply with any possible dispositions for impact mitigation and for monitoring the works and the power plants.	C	VIA (Evaluation of the Impact on the Environment) Ministry dispositions received by the AIA (Integrated Environment Authorization) 2007. Regional VIA dispositions will be received in the new AIA.
6) Activities that undergo anti-fire standard			
a	Description of the systems and of the activities that undergo CPI – Fire Prevention Certificate - (for each power plant/building list each single activity that undergoes CPI)	C	Category of Activities DPR (Decree of the President of the Republic) n. 151/11: 1-2-3b-6-12-13a-36-49-74 (RdS (System research)/11 page 20)
b	Check evaluative evidence for fire risk	C	In DVR(Risk Evaluation

	DISPOSITION	STATE	NOTES
			Document) May 2012
c	Check document evidence for: Fire Prevention Certificate Specify the progress of the file by identifying the minimum level of acceptability for the certification, i.e. possessing the project approved by VVF approval for the project	C	VV.F. Approval for the anti-fire compliance project (14/11/08 and 05/10/09).
d	Check evidence for: personnel training evacuation drill control, anti-fire equipment maintenance	C	Anti-fire register. Medium risk course for all the 20 members of the fire team held by SIS Studio. (September/October 2012). Semestral check carried out by external company.
7) Use of toxic gasses			
	List of toxic gasses present, followed by quantities and activities to which they are connected	NA	
	Check evidence for: toxic gas authorization		
	Check the involved personnel's qualification (currently valid license); check license renewal for use of toxic gasses released or renewed in 2005: limit date: 26/08/2010)		
8) Air emissions			
	Check that the following have been arranged and updated: list of exhaust tubes and of the air emission locations (identification and origin) the data concerning the features of the *"gas effluents"*, and the related demolition systems, according to the *reports, authorizations and/or possible regulations*	C	AIA (Integrated Environment Authorization)
	Check handling conditions in order to limit widespread (escaping) emissions, e.g. relating to: raw material/product handling and stocking	C	AIA (Integrated Environment Authorization)
	Check existence of a system or power plant booklet for thermal power stations		
9) Greenhouse effect gas emissions			
	People managing devices, appliances and systems regarding refrigeration, air conditioning and hot air pumps and anti-fire systems containing defective fluorinated greenhouse gasses (Reg.CE842/06)*(starting from 4 July 2007):* check that the fluorinated substances in the devices are of a quantity > 3 Kg and are included in Annex I (HFC – PFC – SF6) Re. CE 842/06 check existence of a register check evidence for periodic checks PFC/HFC: - > 3 Kg yearly - > 30 Kg semestral - > 300 kg trimestral	C	N. 8 installed devices inside which there is on average 1 kg of total cooling fluid made up of R407C and R410A that do not contain chloride, do not damage the ozone and have a greenhouse potential below R22
10) Air Environment Quality			
	Firms and Public Institutions with single local units with more than 300 employees and firms with more than a total of 800 workers located in the Municipalities stated in co. 1 of art. 2 of the Ministry Decree 27/03/1998, check document evidence for: appointment of a *"mobility manager"*	NA	

	DISPOSITION	STATE	NOTES
	adopt the *"home-job shift plan"* for the employees (art. 3 Ministry Decree 27/03/1998)		
11) Water drains			
a	Check that the list with the data relating to the specific features of the waste water drains and of the possible treatment systems has been arranged	C	AIA (Integrated Environment Authorization) expiring 2015
b	Search for evidence about documents relating to the application for draining authorization and/or any further amendment	C	AIA (Integrated Environment Authorization)
c	In compliance with the duties existing for the person *"responsible for the activity that originates the drain"* (articles. 124,125. Legislative Decree n.152/06, check the state of the authorization, especially as regards to: Current managing conditions, expiry, authorization renewal (one year before expiry)	C	AIA (Integrated Environment Authorization) - (duration 5 years; to be renewed 180 days before expiry)
d	Assess knowledge about the ban from diluting with "*water gathered on purpose"* (the ban was implemented in order to obtain emission value limits: art. 101, co. 5, Legislative Decree n. 152/06)	C	Ruled by AIA (Integrated Environment Authorization)
e	Check managing conditions for compliance with the established "*emission limits"* (art. 101 and Ann. 5 of part III of the Legislative Decree n.152/06) also in relation to possible regulations established by authorization.	C	Monitoring established by AIA (Integrated Environment Authorization)
f	Check ban for discharging substances into the soil listed in point 2.1 of the annex n. 5 of part III of the Legislative Decree n. 152/06)	C	Ruled by AIA (Integrated Environment Authorization)
g	Assess that operational aspects have been carried out and/or considered in advance for: rationalizing water use in order to reduce effluent output at the source awaken worker to rationalizing consumption and avoiding improper use of water	C	Ruled by AIA (Integrated Environment Authorization)
h	In case of drainage into the soil, check requirement to provide superficial hydric structures, in sewer networks, i.e. destined to be used again, exception made for the cases listed in art. 103, co.1 of the Legislative Decree n. 152/06 Note - In case these rules are not abided by, the drainage authorization is to be considered revoked (art. 103, co. 2, Legislative Decree n. 152/06).	NA	
i	Separazione e trattamento acque di prima pioggia come da regolamento regionale *24/3/2006 n. 4*		
12) Power stations that generate special dangerous and non-dangerous waste			
a	Discuss if and how the waste generated by the power station is identified and classified with the person responsible	C	Waelz slags in waste disposal areas regulated by AIA, as well as the temporary deposit. The stock areas are identified on the VR-1374 with the code CER)

	DISPOSITION	STATE	NOTES
b	Check that the expression *dangerous waste*, is followed by classification criteria (Annex. "D" part IV a of Legislative Decree n. 152/06) based on Annexes. G, H, I)	C	Waelz slags with yearly basic features. Produced waste classification with module 39 (waste technical form)
c	Check ban against mixing dangerous waste with *non dangerous* waste (art. 187 of Legislative Decree n. 152/06)	C	Counter checked with planimetry VR-1374
d	Check ban against mixing different categories of dangerous waste, in compliance with Annex G (art. 187 of Legislative decree n. 152/06)	C	Counter checked with planimetry VR-1374
e	Check that there are no unchecked waste deposits on and in the soil (art. 192 of Legislative Decree n. 152/06)	C	
f	Check (duty for compelled subjects (*) in compliance with art.2 co.24 of Legislative Decree n. 4, 16/01/2008 (new wording of co.3 art 189 of Legislative Decree n.152/06) if there is a *load and unload register* showing waste quantity and quality, with numbered and certified sheets and managed according to the procedures and modalities fixed by the standard on IVA registers (art. 190 of Legislative Decree n.152/06 as amended by art.2 co.24-bis of Legislative Decree n.4/08)	C	Waste produced, except for slags (responsible for the environment). Register R13 (reception). Register R4 register (secretary's office). Waste disposal site register (secretary's office).
g	Check that the yearly MUD (Single Form for Environment Declaration) has been submitted to the Chambers of Commerce (art. 189 co.3 of Legislative Decree n. 152/06, as amended by art.2 co.24 of Legislative Decree n. 4/08)	C	Most recent dates up to 27-04-2012
h	Check that the Organization has identified the applicable fulfillments to be carried out , according to terms and modalities required by art. 1 of Decree 17 December 2009 and further amendments and/or integrations ("come in to operation with the SISTRI Waste Traceability Control System")	C	Subscription of 4 categories
i	Check that the Organization has subscribed to the SISTRI (Waste Traceability Control System), According to the subscription terms and modalities listed in the Decree 17 December 2009 and further amendments and/or integrations	C	Deputies: Busè, Zarini, Delle Foglie
l	Check that the SISTRI (Waste Traceability Control System) has been informed of possible replacements of the people identified as deputies for the procedures listed in the present decree.	NA	
m	Check that the yearly SISTRI fee has been paid.	C	
13) Temporary waste deposit			
a	Check type and quantity of the waste accumulated in the production area	C	
b	Check that the waste deposit has been carried out by dividing the waste on the basis of homogeneous types and by complying with the relating technical standards	C	
c	Check end date for starting discharge/recycling operations	C	Daily operations (except for Sundays) for the slags. Possible temporary deposit authorized by AIA (Integrated Environment Authorization) point C 5.1

	DISPOSITION	STATE	NOTES
			1457 m^3 (used at the end of 2011in its maximum volume measurement) In need of waste that has been produced (load and unload when discharge is being carried out)
d	Check how long the temporary deposit lasts (max 1 year)	C	70 handlings between waste load and unload on the waste register: at least 1 unload a year for routine waste
e	Check safety conditions in the collection and deposit areas for dangerous waste, that must be managed in compliance with the standards that regulate dangerous substance deposit (new art183,co. 1m4, of art 2 co.20 D.Ls 4/08)	C	Areas paved with small gathering channels linked to the sewer. Metal and plastic bins.
f	As far as asbestos waste is concerned, check that: - technical deposit modalities are respected as per work plan or as per reclamation project - that such waste is collected separately from other types of waste, and in case of different types of asbestos, these different types must be collected separately (Annex. A Ministry Decree n. 248/2004)	NA	
14) Delivery of waste/transport of waste			
a	Check beforehand that the personnel is suitable for being responsible for the waste: Members of the Association of transporters and dealers/intermediaries Authorization for the people receiving the waste Communication and membership of the Regional Section Association for people receiving “facilitated” waste	C	Collect authorizations for people that discharge/recycle (A8 register) and transport ANGA (National Association for Environment management) membership (register I3)
b	Check that the waste identification form is issued and filed (art.193 D.lgs.152/06, as amended by the Legislative Decree n. 4/08 art.2 co.25) Please note: exception made for the transportation of the following types of waste: - “*urban*”, carried out by public service - “*non dangerous”, occasionally carried out by the producer for quantities not* > 30 Kg/liters (art.193 co 4. Legislative Decree n. 152/06)	C	Issued by transportation office. Filed by environment office.
c	Check that the 4th copy of the identification form or the Province report do not exceed the terms	C	4th copy until 7 November 2012
d	Check compliance to ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) standard is applied in case the waste rates as “dangerous goods”	C	CER 160601 (H4-H5-H6-H8-H14) carried in ADR with the A129629/09 form, 29/10/12

	DISPOSITION	STATE	NOTES
e	Check European Regulation for waste trans-frontier shipment (to be notified to an Authority by using the standard model, draw up a contact for waste discharge/recycling) (art.194 of Legislative Decree n. 152/06)	NA	
f	Check evidence for managing condition of separate rubbish collection as far as batteries, and accumulators containing dangerous substances are concerned (see art 2, Ministry Decree n. 194/03) and delivery system (a retailer/public (or private) service collection areas (see art. 4 Ministry Decree n.194/2003) Please note: see also art 235 co.12 Legislative Decree n. 152/06	C	In the office building, plastic waste, paper/cardboard waste, toners and cartridges for printers are collected separately. In the power station accumulators and neon lamps are collected separately. In the near future also batteries will be collected separately.
15) Waste Management Activity			
a	Check whether the activity requires subscription to the Waste Management Association (art. 212 of Legislative Decree n.152/06 as amended by art.2 co.30 of legislative Decree n. 4/08)		AIA (Integrated Environment Authorization) – all ordinary activity
b	Check whether the discharge/recycling operations *carry out* is *authorized* (art. 210 of Legislative Decree n. 152/06)		
c	Check managing conditions for compliance with operational dispositions and conditions contained in the authorization (e.g. Limits of emission in the air, precautions, exc.)		
d	Check that when recycling operations are carried out according to conditions and technical standards in compliance with art. 214 of Legislative Decree n. 152/06, they are based on "*opening activity report*" (art.216 co.1 of Legislative Decree n. 152/06) and *"subscription" Regional Section of the Association* (art. 216 co.3 of Legislative Decree n. 152/06)		
e	Check that the "*opening activity report*" is renewed every 5 years or renewed whenever substantial changes in recycling operations should occur (art. 216 co.5 of Legislative Decree n.152/06)		
f	Check existence of a load and unload register where quantity and quality of waste are noted (art.190 of Legislative Decree n. 152/06, as amended by art.2 co.24-bis of Legislative Decree n. 4/08)		
g	Check that the yearly application for the MUD (Single Form for Environment Declaration) has been forwarded to the Chambers of Commerce (art.189 of Legislative Decree n. 152/06, as amended by art.2 co.24 of Legislative Decree n. 4/08)		
h	For *admitted non dangerous waste* recycle with the simplified procedure in compliance with art.214 of Legislative Decree n. 152/07 check document evidence that ascertains that a chemical-physical analysis is carried out on the waste every 24 months and whenever a substantial change in the process should occur (sampling and analysis as per art. 8 Ministry Decree n. 5/02/1998) Please note that the prescriptions contained in Ministry Decree 5/02/1998 are applied in the situations identified in co.5 art.214 of Legislative Decree n.152/06		
i	For *non dangerous waste stocking* that undergoes the simplified procedure in compliance with art.214 of Legislative Decree n. 152/07, check evidence for managing conditions (separate		

	DISPOSITION	STATE	NOTES
	stocking/heap protection/basin containing liquids, exc.) contained in art. 6 Ministry Decree 5/02/1998 Please note that the dispositions contained in DM 5/02/1998 will be applied to the conditions identified by co.5 art.214 of Legislative Decree n. 152/06		
l	Check that inflammable or decomposable waste stocked at the recycling systems R 13 is subject to a "simplified procedure" in compliance with Legislative Decree n. 152/06 only if it does not go over 600 sqm and the deposit is not prolonged for a period of more than one year (art. 7, co. 3 Ministry Decree n. 05/02/1998) Please note that the dispositions contained in Ministry Decree 5/02/1998 will be applied to the conditions identified in co.5 art.214 of Legislative Decree n. 152/06		
m	For *admissible dangerous waste recycling* that undergoes the simplified procedure in compliance with Legislative Decree n. 152/06, check document evidence for: chemical-physical waste analysis carried out every 12 months or whenever a substantial change in the process (sampling according to UNI Standard 10802 and analysis as per art. 7 Ministry Decree n. 161/2002)		
n	For *dangerous waste stocking* that undergoes the simplified procedure in compliance with DM 161/2002, check document evidence for: quantitative stocking and timing conditions as per art. 4 DM 161/2002 in compliance with the technical rules contained in Annex III Ministry Decree n.161/2002 Please note that the dispositions contained in Ministry Decree n.12.06.2006 are applied to the conditions listed in co.5 art.214 of Legislative Decree n. 152/06		
16) Second hand oil			
	Check that stocking conditions meet safety, strength, labeling and protection requirements contained in art. 2 of Ministry Decree n. 392/1996; or, in case of stocking systems with a capacity of over 500 liters, stocking conditions should meet the requirements contained in Annex C of Ministry Decree n. 392/1996 (fencing 2,5 m minimum height, steel tanks, containment basin, exc.)	C	460 kg tank with containment basin in the workshop
17) Underground tanks			
a	Check registration with the Region by 13/02/2001	NA	
b	Check that a good management procedure has been determined and implemented, in order to prevent release and leaks (art. 8 DM 246/99) related to the number, capacity and content of underground tanks.	C	Instruction n. OW13 revision in force
c	Check residue life expiry, resistance tests, reclamation and abandonment of the existing underground tanks	NA	
18) Relevant accident danger control			
a	Check that: the *power station* is included in the field of application of the standard (presence of dangerous substances listed in the Annex I part I and II of Legislative Decree n. 334/199 as amended by Legislative Decree n. 238/05) a procedure for periodic control of the type and quantity of substances is determined, as stated in the dispositions contained in the standard	C	Dangerous substances for the environment (entering waste >2000 tons); art.8 zinc oxide It is linked to the authorized stocking quantities
b	Check evidence for connected duties (if applicable) relating to forecasted deadlines: *notification (art.6)* *internal emergency plan (art. 11)* *prevention policy (art. 7)*	C	Notification and information (27 October 2011)

	DISPOSITION	STATE	NOTES
	Safety Management System (art. Annex III, art. 7) *According to the guidelines contained in Ministry Decree n. Environment 9/08/2000* *informing citizens (Annex V, art. 5)*		Internal emergency plan (18-2-2011), Policy and SGS (Safety Management System) manual (19-1-2010)
c	Has the person managing the power stations (in compliance with article 8 of Legislative Decree n. 334, 1999, according to the objective listed in article 1, comma 1) consulted the personnel working in the power station through the representatives of the workers about safety in compliance with article 47 of Legislative Decree n. 81, 9 April 2008, and further amendments?	C	SGS manual delivered to RLS (Responsible for Workers' Safety Ugo Marelli 24-5-2010) Waelz oxide safety form delivered to RLS (Responsible for Workers' Safety- Omar Cabrini 01-7-2011) Operative manual for Waelz oxide production delivered to RLS (Responsible for Workers' Safety- Omar Cabrini 6-9-2011)
19) Sound emissions			
a	Check evaluations concerning compliance with maximum limits of exposure	C	
b	Check that survey and measurement techniques for noise comply with the requirements of Ministry Decree 16/03/1998 Pay attention to measuring equipment and calibration certificate (see art. 2), measuring modality (see Annex B)	C	
c	Check that the report showing outcomes from the survey meets the requirements contained in Annex D of Ministry Decree 16/03/1998 Please also note day, place and time of the survey, reference, observation and measurement time, identity and signature of the technician employed	C	
d	Search evidence for the *sound restoration plan (if applicable)*	NA	
20) Dangerous substances and mixtures			
a	Check that classification criteria correspond to art. 31 of EC Regulation 1907/2006 (Reg. REACH)	C	Waelz oxide registration (15-11-2010). Waelz slag registration (24-11-2010)
b	Sample check the *"safety sheet"* for dangerous substances and mixtures and also the relative management modalities (e.g. Update modality)	C	Waelz oxide safety sheet (rev. 7 in force) Slag basic characterization (rev. 5 in force)
c	Check that the *"safety sheet "*: contains the n. 16 required entries, filled in according to the "guide" in the Annex of Ministry Decree 7/09/2002 is written in Italian (art. 4 Ministry Decree 7/09/2002)	C	

	DISPOSITION	STATE	NOTES
d	Check managing procedures related to safety sheet update	C	Safety sheets (S/5 register updated to 21/11/2012)
21) Transport of dangerous goods			
a	Check that the standard for dangerous goods to be transported is applied according to the type of transport	C	Waelz oxide in ADR, RID and IMG
b	Check managing modalities according to the labeling and the writing on the packaging/boxes	C	Product shipped in randomly labeled containers
c	Check appointment and qualification of the person responsible for safety and transport and also that the authorities have been informed	C	External consultant Daniele Contini ADR, RID and IMG report 26-2-2008 to the civil traffic control authority of Bergamo
d	Check that the "annual report" has been written	C	Filed by the person responsible for the environment
e	Check that the classification of dangerous goods has been updated and adjusted to the purpose of travel by sea according to paragraph 2.5.3.2.5 of the IMDG code (24/06/2008 Decree (published on the Official Gazette n. 16718/07/2008)	C	
22) Save on energy			
	Check energy manager appointment for the forecasted energy consumption	C	Responsible for the environment: the appointment depends on anthracite and coke as combustible material and not as reagent
	Check document evidence that proves that the dispositions contained in the President of the Republic's Decree n.551, 21/12/1999, and regional regulations concerning the use and maintenance of the *thermal power plants* inside the buildings, especially: maintenance carried out combustion efficiency control power plant/station booklet	C	Vapor production for the crystalizing system with diathermic hot oil heater (methane)
	Check that in the improvement programs there are energy requalification objectives (Ministry Decree 11-3-2008)	C	The AIA (Integrated Environment Authorization) includes the replacement of devices at the end of their working life with more efficient new devices (electric engines)
23) Water sources			

	DISPOSITION	STATE	NOTES
a	Check that each source of water drainage has its own documents/authorizations.	C	AIA (Integrated Environment Authorization)
b	Check that in the meantime suitable measures have been taken in order to carry out disposal, to avoid waste, to reduce consumption and to encourage recycling, also by using the best technology available (art. 98 of Legislative Decree n. 152/06)	C	AIA (Integrated Environment Authorization)
c	Check that capacity and data transmission measures have been installed by the licensing Authority	C	Annual Report on water originating from the Province of Bergamo (most recent 20-3-2012)
d	Check permit on behalf of the Civil Engineer	C	From the Crocefisso spring: 15-5-1953 Ministry Decree 1980 renewed on 13-5-1983 3 integrated on 17-3-98 From Riso and Musso creeks: 10-10-1929 RD 7871 renewed on 21-08-1989 and integrated on 30-06-1999
24) PCB-PCT			
a	Check list of devices/systems/fluids on site containing PCB/PCT	C	Environment manager
b	Check that the reference methods contained in art. 3 of Ministry Decree 11/10/2001are used for the “analytic determinations”	C	External laboratory
c	Check evidence that proves that the devices/systems/fluids containing PCB/PCT have been reported within the prescribed limits Please note that the report to the Waste Land Register (Regional Section at the Regional Environment Protection Agency) must be carried out by using the forms approved by art. 4 of Ministry Decree 11/10/2001, and enclosed in the Ministry Decree	C	Report to ARPA every two years (27-12-2010)
d	In the event of decontamination of the transformers, check compliance with the dispositions contained in art. 2 of Ministry Decree 11/10/2001	C	In 2010
e	Check equipment labeling management	C	
f	Check that the Province responsible for the territory has been informed, thus granting compliance with the dispositions contained in art. 1 of Ministry Decree 11/10/2001	C	Report to ARPA every two years
25) Asbestos			
a	Check that suitable measures have been arranged to evaluate the conditions regarding the presence of asbestos	C	Dismantling of Roofing planned by 2013.
b	Check that a list of all the equipment present on the Site that could contain asbestos has been written off and if there is any piece of equipment containing asbestos, check that the following measures have been considered	C	
c	Check that a person “responsible for the structures containing asbestos” has been appointed in compliance to Ministry Decree 6.9.1994	NC	
d	Check document evidence for the application of a “*notification*” *(*)* (Legislative Decree n. 257, 25.07.2006) forwarded by the	C	Notified to ASL (Local

	DISPOSITION	STATE	NOTES
	employer to the qualified vigilance organ for the territory before the beginning of the work in compliance with article 246 of Legislative Decree n. 81/2008 (that replaces art. 59-bis of Legislative Decree n. 626/94 (maintenance, demolition, waste disposal, reclamation, exc.) The notification must contain the following: - construction site location; - types and quantity of asbestos being handlled; - actions and procedures being applied; - number of workers involved; - starting date of the work and duration; - measures being adopted to limit worker exposure to asbestos.		Healthcare Company) Bergamo 8-4-2008 with the inventory. Inspection of air dispersed fibers in 2007: concentration < 1 fiber/liter.
e	In case of "*Asbestos demolition or removal jobs*" Check document evidence that: such jobs are carried out only by firms that meet the requirements contained in article 30, co. 4, Legislative Decree n.22, 5 .02.97. the employer prepares a "*work plan*" containing the necessary measures for guaranteeing workers' health and safety in the workplace and the protection of the surrounding environment before beginning the asbestos (or material in contact with asbestos) demolition or removal job from buildings, structures, equipment and systems and means of transport. the "work plan" is forwarded to the vigilance organ at least 30 days before the jobs begin (such fulfillment replaces the "notification" hereto in point d)	C	File prepared by the supplier (Tecnostrutture), Internal contact Mr. Palazzi (RSPP).
26) Integrated pollution control			
a	Check with the Head Office whether there is evidence that the ("new" or "existing") activity falls (or not) within the annex n. I of Legislative Decree n. 59/05	C	2.5a waelz (power systems for raw non-iron concentrated metal extraction ...). 5.4 waste disposal areas that receive more than 10 tons/day.
b	If the activity falls within Legislative Decree n. 59/05, check awareness of duties related to obtainment, renewal, and further examination of the Integrated Environment Authorization (AIA)	C	Latest renewal of the regional AIA decree n. 10115, 07-10-2010
c	Check evidence that there is a suitable knowledge about the best techniques available (see Annex IV and art.14 co.4 of Legislative Decree n. 59/05 , BREF (Best Reference Documents) elaborated within the EC and the guide lines for BAT(Best Available Techniques) issued by the Ministry for the Environment) applicable by the activity included in Annex I	C	AIA (Integrated Environment Authorization) framework D
d	For those who manage power plants relating to the activities listed in Annex I of Legislative Decree n.59/05,check document evidence for "reports" addressed to Authorities (by 30th April of every year) concerning the data relating to the emissions of the previous year (Art.12 of Legislative Decree n.59/05)	C	E-PRTR (European Pollutant Release and Transfer Register) Statement, 12-4-2012, that surpasses the threshold values for waste produced and disposed out of the site
e	The managers of the power plants that possess AIA (Integrated Environment Authorization) should check the managment conditions for compliance with the dispositions contained in the AIA(Integrated Environment Authorization), and/or imposed by	C	AIA (Integrated Environment Authorization) monitoring

	DISPOSITION	STATE	NOTES
	the Authorities (art.7 Legislative Decree n.59/05)		plan
f	Check managing conditions for compliance with the duty (on behalf of the IPPC -Integrated Pollution Prevention and Control- activity manager) to inform the qualified Authority and the Town Councils involved of the data concerning the emission measurement (art.11 co 2 of Legislative Decree n.59/05)	C	AIDA (Integrated Self-Control Applicative) for AIA (Integrated Environment Authorization); SME (Constant Emission Monitoring System) procedure for the E16 activated since 10-7-2011. Daily reports via e-mail to the Municipalities of Gorno, Premolo and Ponte Nossa concerning TOC (Total Organic Carbon) emissions at the E16
g	Check that managing conditions and the IPPC (Integrated Pollution Prevention and Control) activity manager complies with the duty of reporting the "planned power plant changes" to the qualified Authority, as defined in art. 2, comma 1,letter m (art.10 of Legislative Decree n. 59/05)	C	Reports concerning adjustments to the dispositions required by AIA (Integrated Environment Authorization) 2007
h	Check that the organizations involved (IPPC groups) have carried out their duty (by 30 June 2008) of transmitting the information	C	Monitoring data in AIDA (Integrated Self-Control Application) from 1-4-2008
27) Polluted Sites			
a	Check with the Head Office whether there is evidence that the site can be considered or not a "*Contaminated site*", e.g. for previous events, in compliance with art. 240 co 1. letter e) Legislative Decree n.152/07	C	Mud stack secured ex art 17 Ronchi decree. Monitoring plan started on 19-7-2011.
b	If it is the case, check with Head Office: fulfillment of the duty to "*immediately inform*" the Province and the Town Council of the "*accomplished surpassing*" of the "*threshold contamination concentrations*" *(CSC)* even for one single parameter and the indicated preventive and securing emergency measures that have been adopted (art.242 co.3 of Legislative Decree n. 152/06) plan to put into practice the actions contained in the report and send a "*characterization plan*" to the Region (**) within 30 days after the report (art.242 co.3 of Legislative Decree n. 152/06) *"risk analysis procedure"* effects and current state of the "*operational or security project" (art. 242 co.7 Of Legislative Decree n. 152/06*	NA	
28) Waste disposal areas			

	DISPOSITION	STATE	NOTES
a	Ask for document evidence concerning the state of the Authorization for constructing and managing the waste disposal area	C	AIA (Integrated Environment Authorization)
b	In case of dangerous waste deposit, check that the load/unload register contains the suitable mapping for identifying the sector of the dump where the single piece of waste is disposed of (art. 11, co. 3d, Legislative Decree n. 36/2003)	NA	Mono-waste dump
c	Check document evidence that the "dump adjustment plan" has been *"submitted to the qualified Authorities"* (by 27/09/2003) in compliance with the dispositions in Legislative Decree n. 36, 13/01/2003 (art. 17, co. 3, Legislative Decree n. 36, 13/01/2003)	C	First adjustment plan submitted on 24-9-2003 to the Lombardy Region in compliance with Legislative Decree n. 36, 13-1-2003; dispositions previously received in DGR (Regional Junta Deliberation) and then in AIA (Integrated Environment Authorization)
29) Electromagnetic pollution			
	LOW frequency – for exposure to electric and magnetic fields with a frequency of 50 Hz and generated by power lines (art. 3, DPCM 8/07/2003 – Official Gazette n. 200, 28/08/2003): Ask for evidence of managing measures for the compliance with the required *"exposure limits"* (100 µT for magnetic induction - 5 KV/m for the electric field, intended as effective values)	NA	ENEL Power line 130 kV
30) Photopollution			
	Check that an evaluation of the technical features of the external lighting systems carried out. The external lighting systems must have a maximum light intensity of 0 candles (cd) for 1000 lumen of total luminous flow emitted for gamma angles higher than 90° and must be provided exclusively with the best possible efficiency related to the current technology. They must be equipped with luminous flow reducers capable of reducing the flow generated by the lamps by 30% compared to the full operating regime after 12:00 a.m. All the already existing highly polluting light sources, such as globes and lanterns, must be shielded or provided with suitable devices that can limit the light flow and direct it towards the ground; however, they must not be over 15 cd for 1000 lumen at 90° and higher, in addition there must also be a transparent protection glass. A derogation has been granted for those below 1500 lumen each (to a maximum of three centers with one single light point). If there aren't any light flow regulators, whoever is responsible for energy consumption reduction can intervene by switching off 50% of the light sources by 11 p.m. during the period of the year with solar time, and by 12 a.m. during the period with legal time.	C	Lights aimed towards the ground. Lighting is made functional for personnel safety (continuous cycle system)