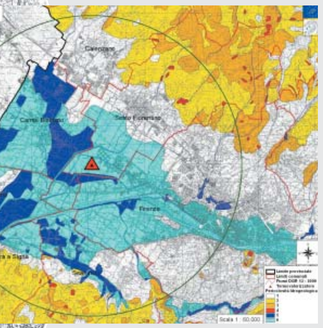
## Objectives

The main target of the study is to develop a correct and rigorous scientific methodology (Health Impact Assessment, HIA) that can be transferred into a tool for future land-use development and planning.
The specific aim of the case study, about which the tool is developed and set-up, is to assess if the insertion of the waste-to-energy plant within a specific area can bring benefices or negative effects on the health of the area inhabitants and to propose and verify integrations and modifications with respect to the initial solution.




## Actions

The study activities have been dived in the following phases:

- Description of the study area in terms of natural and environmental characteristics;
- Detailed study of the waste-to-energy process to be inserted in the area;
- Characterization of the resident population in the area, in terms of health status;
- Prognosis of the pollutant load in the future scenario (by means of diffusion models);
- Identification of "mitigation" actions with respect to the pollution prognosis (alternative planning or cha ges to the project) and "recommendations" to the decision-makers;
- Guide lines for the monitoring plan;
- Guide lines for the correct application of the HIA methodology;
- Communications and results dissemination.

## The study area

The boundaries of the study area have been identified, in the preliminary phase, within 8 km with respect to the hypothetical localization of the new waste-to-energy plant (Osmannoro). The area so defined has been characterized by the environmental and natural point of view (orography, hydrography, bonds, soil use, sides instability, etc.). The collected information have been organized and represented on GIS system. Afterwards, the simulation area has been limited at 2,5 km of radius with respect to the plant location, defined on the basis of maximum concentration radius.

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## The HIA methodology

The HIA was defined by World Health Organisation as *"the estimation of the effects of a specified action on the health of a defined population"*.
Gothenburg Consensus Paper, ECHP, WHO Regional Office for Europe. (1999)

The aim of the methodology is to value territorial planning decision potential effects on the human health, improving the quality of public policy decision making, through recommendations to enhance predicted positive health impacts and minimise negative ones.

**The VISP project**, is at the present one of few application HIA at national level. The experience carried out in the project has been of particular interest for the following reasons:

- the methodology has been correctly applied as support to the planning tools and it has supplied indications and recommendations to decision makers in relation to the mitigation action definition;
- the followed approach has necessarily been multidisciplinary and integrated with the involvement of reliable subjects.

Moreover, the carried out work highlights the methodology effectiveness and it will be valid reference for its correct application.


The present documentation belongs to materials produced in the project VISP LIFE 02 ENV/IT/ 000018 *"Health impact assessment as territorial planning tool"* and it has been realized with the European Commission financial contribute.


It is possible to download copy of the produced material at the website **www.progettovisp.it** or to require it to:


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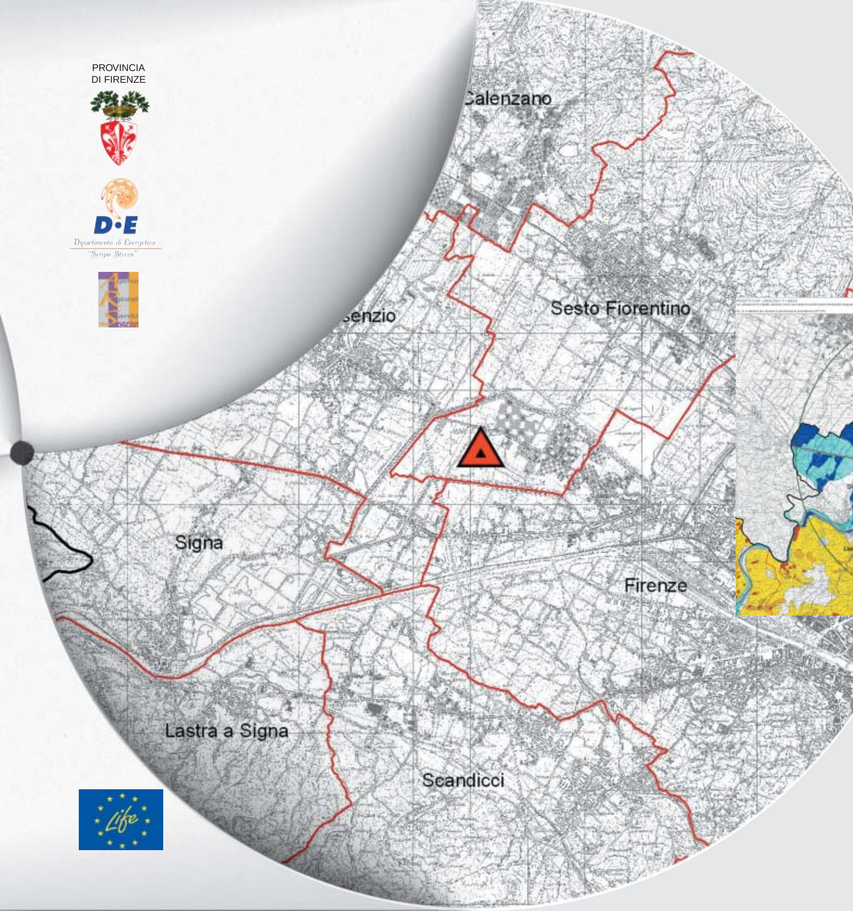
Design CD&V Firenze


# VISP project

Health impact assessment as territorial planning tool

PROVINCIA DI FIRENZE

D·E Dipartimento di Energetica "Sergio Stecco"

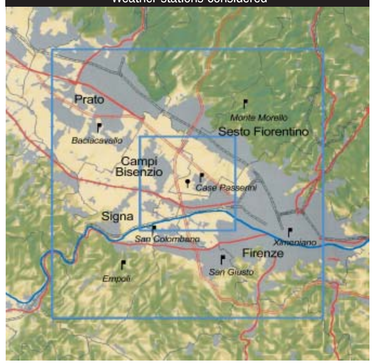



Life program - LIFE ENV 02/IT/000018

# Environmental analysis

Preliminarily, with respect to the diffusion study, the meteorological characterization of the area (year 2000 – provincial monitoring net of Florence and the Istituto Idrografico e Mareografico net), a statistical analysis of hourly data has been carried out to evaluate the exactness of the measures.
A statistical analysis of hourly data has been carried out to evaluate the exactness of the measures.
A detailed study has been carried out on the meteorological characteristics that mainly affect the atmospheric diffusion parameters (Pasquill class and prevalent wind direction).
Besides, all anthropical sources present in the area (landfill, composting plant, storing and transfer area, urban waste collection and transport, road transport, diffused emissions, natural areas) have been identified and characterized, in terms of emissions of the pollutants of interest, with reference to two different scenarios:
• Present scenario: data refer to 1999/2000;
• Future scenario: data fluxes of urban waste refer to year 2007 (Wastes Provincial Plan Management).

Weather stations considered




The atmospheric pollutant diffusion study (ISC3, SAFE-AIR, CALPUFF, CALINE4, CALQ3C) has been carried out with reference to the pollutants summarized in the table.
The selection of these compounds came from a critical revision of the available scientific literature about the emitted substances by waste combustion systems and about their effects on the human health.
The pollutant sources emissions present in the area of interest have been divided into three typologies reported in the following.

| |
|---|
| Nitrogen Oxides (NOx) |
| Sulphur Oxides (SOx) |
| Cadmium (Cd) |
| Mercury (Hg) |
| Lead (Pb) |
| Dusts ($PM_{10}$) |
| Benzene |
| Toluene |
| Xylene |
| Dioxins (PCDD/PCDF) |
| Polycyclic Aromatic Hydrocarbons (PAH) |

| | |
|---|---|
| SIGNIFICANT POINT SOURCES | Concentrated stack emissions characterised by significant pollutant quantities |
| SIGNIFICANT LINEAR SOURCES | Main traffic emissions |
| AREAL OR DIFFUSED SOURCES | Emissions from both not concentrated and concentrated but not significant sources (secondary roads, punctual and areal emissions, etc) |

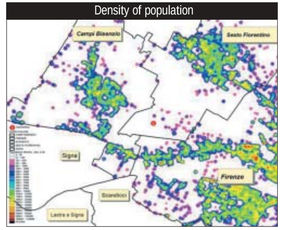
The simulations results have been represented on maps with receptors and pollution sources geographical reference.

# Health analysis

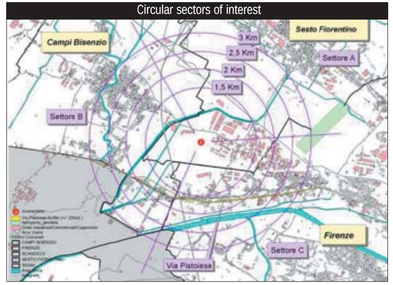
The part of the study more concerned with health has been carried out by ARS (Regional Health Agency) in external assistance and it involves the characterization of the resident population present state of health.
In particular, the occurrence of pathologies due to environmental pollution factors, potentially related to waste-to-energy plants, has been analysed in detail in order to identify the presence of statistical significant excesses.
The population data from municipal registers have been stored on GIS system using vector cards of civic numbers. With respect to the plant location, four circular areas of radius 1.5, 2, 2.5 and 3 km, and subdivided in three sectors (A,B,C) have been considered for the analysis.

Within these circular areas and sectors, the presence of statistical significant excesses in the occurrence of predefined pathologies has been searched, considering as comparison the number of expected cases in a reference area, defined as the entire Provincia di Firenze territory.

Density of population




Circular sectors of interest



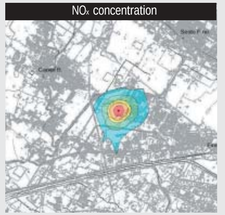

RESULTS

## "Osmannoro 2000" location waste-to-energy plant results

The simulations results show that the pollutant concentrations caused by the insertion of the waste-to-energy plant, for all considered indicators, are fully lower than the comparison limits (quality of air limits, and when quality of air limits not are available work exposition limits or – for dioxins – data collected in survey campaign by ARPAT on Florentine area). Even in some cases concentrations are not significant.

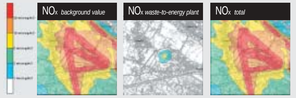
| | RESULTS MAXIMUM VALUE | REFERENCE TERMS | NOTES |
|---|---|---|---|
| $NO_x$ | 5 μg/m³ | **Quality air limits** D.M. 2 april 2002, n. 60 *40 μg/m³* | Eight times under limit value for air quality. Going away from the stack the concentration values are two orders of magnitude lower than limit values. |
| $SO_2$ | 0,03-0,35 μg/m³ | **Quality air limits** D.M. 2 april 2002, n. 60 *350 μg/m³ hourly mean 125 μg/m³ daily mean* | With respect to air quality limit concentration values are not significant. |
| $PM_{10}$ | 0,1 μg/m³ | **Quality air limits** D.M. 2 aprile 2002, n. 60 *50 μg/m³ hourly mean 40 μg/m³ yearly mean* | Concentration values are not significant |
| Pb | millesimi di ng/m³ | **Quality air limits** D.M. 2 april 2002, n. 60 *0.5 g/m³ yearly mean* | It is evident the insignificance of the concentrations due to waste-to-energy plant, limited to the nearest area of the plant. |
| Benzene | decimi di ng | **Quality air limits** D.M. 2 april 2002, n. 60 *5 g/m³ yearly mean* | Four orders of magnitude lower. It is evident that the concentrations due to waste-to-energy plant are insignificant |
| Cd e Hg | decimi di ng | **Work exposition limits** | Five orders of magnitude lower than the limits in work environment. |
| Toluene | 0,1-1,5 ng/m³ | **Work exposition limits** | Concentrations are negligible. |
| Xylene | 0,05-0,4 ng/m³ | **Work exposition limits** | Concentrations are insignificant. |
| PAH | 0,7- 1 pg/m³ | **Quality air limits** D.M. 25/11/94 *1 ng/m³* | Three - four order of magnitude lower than air quality limits. Negligible impact. |
| PCDD/F as T.E. | 2 fg/m³ | **ARPAT survey campaign Florentine area** | PCDD/F concentrations are lower than levels existing in areas uncontaminated by anthropical sources. These values are insignificant with respect to concentration levels in the urban area. |

$NO_x$ concentration



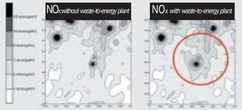

## Waste-to-energy plant – linear sources comparison

The only pollutants for which the concentration values caused by the waste-to-energy plant are comparable with those due to linear sources are cadmium – linear sources contribute is predominant in the road vicinity, while waste-to-energy plant contribution is higher in its own nearness and where linear sources contribute gets lost – and in minor amount dioxins, for which however the estimated concentrations are lower than the monitored levels by ARPAT in Florence urban area. For the other pollutant concentration values due to road traffic are higher than those caused by the waste-to-energy plant.



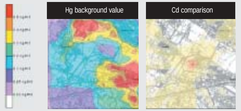

## Waste-to-energy plant – significant point sources comparison

The only pollutants for which the waste-to-energy plant and point source concentrations are comparable are NOx and $SO_2$. However, the ratio waste-to-energy to point sources is always lower than 1/10 and decreases to 1/100 going away from the plant, confirming a limited contribute with respect to the existent point sources. For the other pollutants the concentration values caused by the waste-to-energy plant are completely negligible.




## Waste-to-energy plant – diffused sources comparison

The only pollutants for which the concentration values caused by the waste-to-energy with respect to existing values (in terms of emissions produced by all diffused sources) are appreciable are mercury and cadmium. However, the concentration values at soil level are extremely low with respect to the human health safeguard limits. With regard to the other pollutants, the waste-to-energy plant contribute is always lower than existent pollution levels and in some cases (lead and benzene) is negligible.

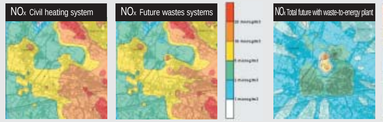



## "Mitigation" actions

A very important phase of the project concerns the definition of "mitigation" actions, with respect to the effects caused by the waste- to-energy plant insertion in the territory. The aim of this activity is supplying to decision-makers information about the pollutant distribution for each potential project change.
At the end of the study, guide lines for the correct application of the HIA methodology and for the possible monitoring plan predisposition have been defined.

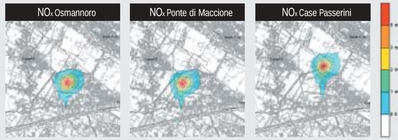
***District heating system***

The effect caused by the emissions of boilers for civil heating has been considered, with respect to the possible option of heat cogeneration from waste-to-energy plant and from landfill biogas. The use of cogenerated heat for district heating and/or industrial heating, in the area nearest to the plants (about 2 km), has been suggested. A potential improvement, by the point of view of air quality, has been estimated, particularly in the area more involved by the substitution of the district heating.




***Changing the location of the waste-to-energy plant***

As an alternative to the original plant location (Osmannoro), other sites, already indicated by the Waste Management Provincial Plan, Ponte di Maccione and Case Passerini, have been considered. Obviously, the stack position change produces the shifting of the area with higher environmental load, together with the stack itself. Therefore, in the case of the stack location northward (Case Passerini), the area with higher concentrations falls on less urbanized areas (southward). While the results for the Ponte di Maccione site (very near to Osmannoro) are essentially the same.
From the health point of view, in the case of Ponte di Maccione site, the population living in the area of interest is the same of the Osmannoro case. Results are similar to those of Osmannoro, even if slightly reduced for west sector (B), that includes Campi Bisenzio population. In reference to Case Passerini site, there is a lower number of resident population in the area of interest, especially in the first circle next to the plant. This situation lowers the number of possible exposed people, but also the statistical reliability of the analysis.




***Roaad condition modifications***

Modifications to the traffic conditions in the study area, have been considered, with reference to two scenarios:
• **scenario 1**: traffic reduction of 5% on Pistoiese road, Pratese road and A11 highway link, with integration of third lane on the urban segment of A1 highway;
• **scenario 2**: traffic reduction of 15% on Pistoiese road, Pratese road and A11 highway link, with integration of third lane on the urban segment of A1 highway.
The estimated effect is a substantially improvement on the environmental conditions for all considered pollutants and the emission reduction in some cases till 50%.

***Green area realization***

In this phase of the project the possibility of realising green areas as potential mitigations to the pollution effects has been considered. The carried out study has highlighted that the considered hypothesis is able to effectively limit the pollutant diffusion. The estimated effect is the potential improvement of the air quality by means of composite physical and biological actions, both on the dusts and on the gaseous fraction of the pollutants.