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Air pollution and air quality state in an Italian National Interest Priority Site. Part 1: the emission inventory

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Abstract

In Campania region, southern Italy, a National Interest Priority Sites (NIPS) was identified: "Litorale Domitio-Agro Aversano" NIPS L.426/98, that includes a large part of the polluted agricultural land, belonging to more than 61 municipalities in the Naples and Caserta provinces. This paper represents a synthesis of a study developed for a LIFE project (LIFE11/ENV/IT/275–ECOREMED): "Implementation of Eco-Compatible Protocols for Agricultural Soil Remediation in Litorale Domizio-Agro Aversano NIPS". As well known, the pollutants of the air may have an impact on the soil pollution; the contribution of the paper to this LIFE project is to provide the environmental characterization of the area, estimating the total annual emissions of the main air pollutants (CO, VOC, NOX and PM10) in the area under investigation, with municipal spatial disaggregation. The amounts of air pollutants emitted from various sources in this area were obtained through direct and continuous measures for the principal industrial systems, while for diffused sources the emissions were estimated on the basis of opportune activity indicators and fixed emission factors concerning specific emissive activities.

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Keywords: emission inventory; bottom-up approach; industrial pollution sources; COPERT methodology

1. Introduction

The past century witnessed a relevant increase in global pollution due to the high production and use of petroleum derived compounds which were carelessly released into the environment. As a consequence numerous organic contaminants are now present in soils and water of terrestrial polluted sites. Furthermore industrial plants, mining

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industry, road transport and the unwise application of fertilizers increased the extent of soil pollution by potentially toxic elements (PTEs), which represent a relevant environmental concern due to their potential accumulation in the food chain.

In Campania region, Southern Italy there were identified four National Interest Priority Sites (NIPSs), for a total surface of about 200.000 ha, with different levels and sources of pollution (Napoli Orientale, Litorale Domitio-Agro Aversano NIPS L. 426/98, Napoli bagnoli coroglio L. 388/2000, Litorale Vesuviano L. 179/2002, Bacino idrografico del Sarno L. 266/05; Aree di Pianura DM 445/2008). Litorale Domitio-Agro Aversano NIPS includes a large part of the polluted agricultural land, belonging to more than 61 municipalities in the Naples and Caserta provinces. In this area, asbestos cement production, unwise municipal solid waste management and road traffic are the main sources of pollution; however, a high level spotted soil contamination is moreover due to the outlaw industrial and municipal wastes dumping, with hazardous consequences also on the quality of the air and water table.

In example, in Giugliano municipality the environmental national protection agency is carrying out the monitoring of 190 wells in order to assess the quality of the water for irrigation. Previous analyses evidenced in some points high contents of tri- and tetrachloroethylene, organic pollutants with a very high cancerogenic potential. It was also been identified an area of about 700 ha known as Laghetti di Castelvolturno in which high levels of lead and antimony were detected in soil since this area was a shooting range for a long period. On the other hand a spread and low level contamination is mainly due to the use of low quality compost and in surface depositions of particles from waste combustion. In both cases the agricultural activities could be compromised threatening the supply chains of PDO products such as the "Mozzarella di Bufala Campana", with high economic, social costs for the population. Moreover there is a general perception of health risks due to the contamination of human food and air; recent studies carried by the International Society of Doctors for the Environment evidenced a 20% increase of human cancers in Naples and Caserta provinces [1].

This paper represents a synthesis of a study developed by the Department of Industrial Engineering (University of Naples Federico II) for a LIFE project (LIFE11/ENV/IT/275 – ECOREMED): "Implementation of Eco-Compatible Protocols for Agricultural Soil Remediation in Litorale Domizio-Agro Aversano NIPS". The contribution of this study to this LIFE project is to provide the environmental characterization of the area, estimating the total emissions of the main air pollutants (CO, VOC, NO_X and PM_{10}) in the area under investigation. The objective was to produce an air pollutants emission inventory for this NIPS area with a bottom-up approach, focusing at regional level instead of national, then including local and definite parameters.

This inventory expressly include a distribution in space, with communal disaggregation, for all the emissive sources, classified in different categories. Among these, two categories of emission sources were taken into account in great detail: mobile sources (meaning the road traffic) and stationary sources (mainly industry and power plants). These sources, in fact, represent in many European country the lion part of the anthropogenic emissions for the contaminants considered in this paper: carbon monoxide, nitrogen oxides, particulate matter (PM_{10}), and volatile organic compounds.

In this study the emissions from the most important industrial systems were estimated with the availability of direct measures, while for the main diffused sources the pollutant emissions were calculated on the basis of opportune activity indicators for each specific emissive activities and of pertinent emission factors. Emissions from road traffic, that in Europe are almost always an important fraction of the total emissions [2] and are also the most difficult to calculate than other human activities since they depend on many variables (characterized by a high degree of uncertainty), were estimated as accurately as possible implementing the COPERT methodology.

The development of these methodology for comprehensive assessment may return an analysis system intended to provide an objective assessment tool.

2. Methods: the Atmospheric Emission Inventory

The atmospheric emission inventories are a primary and essential cognitive element for the air quality management and are becoming more and more necessary to set up remediation programs in areas characterized by pollution problems. Such inventories constitute a technological, economic and territorial data collection, which concurs to individualize the pollution sources (industrial, civil, transports, etc.), their localization with spatial disaggregation (regions, provinces and towns), the amount and typology of the polluting substance. The emission