World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:9, No:2, 2015

Effects of IPPC Permits on Ambient Air Quality

C. Cafaro, P. Ceci, L. De Giorgi

***Abstract*—**The aim of this paper is to give an assessment of environmental effects of IPPC permit conditions of installations that are in specific territory with high concentration of industrial activities.

The IPPC permit is the permit that each operator should hold to operate the installation as stated by the directive 2010/75/UE on industrial emissions (integrated pollution prevention and control), known as IED (Industrial Emissions Directive).

The IPPC permit includes all the measures necessary to achieve a high level of protection of the environment as a whole, also defining the monitoring requirements as measurement methodology, frequency and evaluation procedure. The emissions monitoring of a specific plant may also give indications of the contribution of these emissions on the air quality of a definite area.

So, it is clear that the IPPC permits are important tools both to improve the environmental framework and to achieve the air quality standards, assisting to assess the possible industrial sources contributions to air pollution.

***Keywords*—**IPPC, IED, emissions, permits, air quality, large combustion plants.

I. Introduction

THE European directive 2010/75/UE [1] on industrial emissions (integrated pollution prevention and control), known as IED (Industrial Emissions Directive), is the legislative instrument in force concerning IPPC (Integrated Pollution Prevention and Control). This directive recasts also the Directive 2008/1/EC [2], concerning IPPC, which codified the Directive 1996/61/EC [3].

It regulates the way to guarantee the prevention and reduction of pollution generated by the major industrial activities, ensuring the achievement of a high level of environmental protection as a whole. The innovative aspect introduced by IPPC legislation since 1996 is an integrated approach to analyze environmental problems originated from installations, not considering separately the individual contributions in the different environmental matrices, but looking at the whole environmental reference situation, to identify all contributions attributed to a specific plant and put in place the corrective actions to obtain a coordinated and complete protection of the environment surrounding the plant.

The categories of industrial activities falling in the IPPC regulation can be divided in six major groups: energy industries, production and processing of metals, mineral industry, chemical industry, waste management, other activities (like production of paper, tanning of hides and skins, disposal or recycling of animal carcases or animal waste etc.).

The IPPC Directive provides a specific permit for each installation.

According to Directive 2008/50/CE [4] on ambient air quality, which could lead to stricter permit condition, the operational conditions fixed in the IPPC permits are also based on the local plans and programmes, as the air quality plans.

The air quality plans can be an efficient tool to assess the possible contributions to pollutants from industrial sources and also to individuate the correct measures to achieve the related limit value or target value. In the same time, the issued IPPC permits might became a valid tool both to improve the environmental framework and to achieve the air quality standards.

This direct link between the air quality law and IPPC law is essential in the areas with a high industrial concentration, where the industrial contribution to the air quality is relevant.

II. IPPC Activities in Italy

In Italy, the previous directive on Integrated Pollution Prevention and Control (IPPC) (Directive 1996/61/EC [3] as codified by Directive 2008/1/EC [2]) was transposed with Legislative Decree 59/2005 [5], recently recasted by Legislative Decree 46/2014 [6] that has transposed directive 2010/75/UE [1].

The Italian transposition of the IPPC regulations introduces an additional distinction between plants under national jurisdiction and plants under regional control. The industrial activities under national competence are the installations considered more pollutants, due to the type of activities or the extension of the plant; for this purpose the decree considers specific threshold limit values referred to the power for energy industries or to the quantity of products manufactured for chemical industries.

Italian IPPC installations are approximately 6000, spread over almost all the national territory, but localized mainly in northern Regions (Fig. 1). Even if numerically the central part of the north of Italy is characterized by a massive presence of industrial activities subject to IPPC, there are some specific industrial areas where more installations, even of different types, such as energy industries, refineries, chemical industries, are concentrated in limited portion of territory. These areas (shown in white in the figure), are located throughout the country and are more exposed to possible changes in the environmental balances, with serious consequences in the different environmental matrices, atmosphere, water or soil, that can represent a high risk factor for environment and population. For this reason these areas

Cafaro C. is with Italian National Research Council – Institute on Atmospheric Pollution at MATTM, Via Cristoforo Colombo, 44 – I - 00147 Rome (corresponding author to provide phone: + 39 06 5722 5018; fax: + 39 06 5722 5087; e-mail: cafaro.claudia@minambiente.it).

Ceci P. and De Giorgi L. are with Italian National Research Council – Institute on Atmospheric Pollution at MATTM (e-mail: ceci.paolo@minambiente.it, degiorgi.loretta@minambiente.it).

are monitored with a special attention in the activities covered by the IPPC regulations.

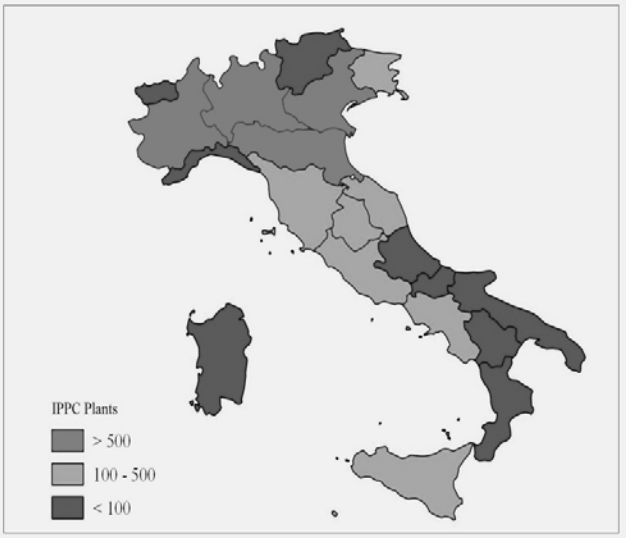

Fig. 1 Regional distributions of IPPC installations (data source [10] data processing CNR-IIA)

III. Air Quality in Areas with High Concentration of Industries

The Directive 2008/50/CE [4] on ambient air quality and cleaner air for Europe and the Legislative Decree 155/2010 [7], Italian transposition of European regulation, govern air quality in order to maintain and, if possible, improve the environmental reference context to safeguard human health, vegetation and ecosystems, identifying and implementing the most effective measures to reduce atmospheric emissions. To this end the Directive confirms the obligation for member States, already present in the previous regulations, to establish specific air quality plans for those zones and agglomerations where the levels of pollutants in ambient air exceed any limit value.

The Air quality plans must be prepared or implemented taking into account all the sources of pollution, such as traffic, domestic heating, agriculture and industrial facilities, to identify the specific contribute of each source and set out appropriate measures to reduce the pollution levels. In this regard, the presence of IPPC activities in a specific portion of territory, can contribute heavily to the overall emissive condition, causing a relevant worsening of environmental air quality. For this reason a careful analysis of the atmospheric emissions of single plants falling in a specific area and the interconnections between different IPPC installations placed in the same area are an efficient additional tool to establish the air quality plans and a good way to define suitable measures to lessen the pollution levels.

In Italy, the comparison of data on environmental air quality with the mapping of IPPC plants distribution, shows, in areas with a greater presence of industrial activities, a widespread critical situation, especially for the parameters NO_2 e PM10, because the normal contribution to these pollutants, mainly due to vehicular traffic, is added to the fraction of industrial origin.

IV. The IPPC Permits and the Air Quality

The IPPC legislation establishes that each installation should operate only if it holds a permit. The permit includes all the measures necessary to achieve a high level of protection of the environment as a whole and to ensure that the installation is operated in accordance with the general obligations of the operator. The permit should also include emission limit values (ELV) for polluting substances, or equivalent parameters or technical measures, appropriate requirements to protect the soil and groundwater. The IPPC permit also defines the monitoring requirements as measurement methodology, frequency and evaluation procedure. The emissions monitoring of a specific plant may also give indications of the contribution of these emissions on the air quality of a definite area.

In the IPPC permits, the BAT Reference Document (BRef) of the European Community, drawn up for defined activities, are the reference documents to set the conditions to operate the installation such as the correct emission limit values linked to the defined industrial activities. In particular, indeed, these documents describe, for a defined activity, the Best Available Techniques (BAT), their applicability and their consumption and emission levels associated. These BAT are set to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole.

In Italy, this new integrated approach has totally changed the licensing framework contributing to the achievement of a relevant emission reduction. In the past, the permits were based on different approaches to controlling emissions into air, water or soil separately which might the shifting of pollution from one environmental medium to another rather than protecting the environment as a whole. By the IPPC permit, the previous authorizations were updated to the real emissive frame of the industrial activities, introducing more stringent measure for a better environmental protection, as stated by European BRefs. Taking as example an existing plant which falls under the definition of "Large Combustion Plant", with a rated thermal input of 50 MW or more, and the two pollutants classes more dangerous for the air quality, NO_X (Table I) and dust (Table II), it is relevant the difference between the previous Italian Legislative Decree 152/2006 [8] limit values and the new limit values based on the emission levels associated with the Best Available Techniques defined by the BRef for Large Combustion Plants [9], which is the document to elaborate the new permits for the national combustion plants with a rated thermal input $\geq$ 50 MW.

The emission levels associated with the best available techniques are the range of emission levels obtained under normal operating conditions using a best available technique or a combination of best available techniques, expressed as an average over a given period of time, under specified reference conditions. If then the emission limit values (ELV) set in the IPPC permit are near to the lower range of emission levels

associated with the BAT, the differences with previous emission levels permitted is obviously significant.

TABLE I
EMISSION LIMIT VALUES (mg/Nm^3) FOR NO_X SET BY LEGISLATIVE DECREE 152/06 FOR AN EXISTENT COMBUSTION PLANT WITH A RATED THERMAL INPUT ≥ 50 MW AS COMPARED WITH THOSE ASSOCIATED WITH THE BAT OF BREF FOR LARGE COMBUSTION PLANTS

Legislative Decree no. 152/06		BRef for Large Combustion Plants	
Capacity (MWt)	**Limit value mg/Nm^3**	**Capacity (MWt)**	**Limit value mg/Nm^3**
		solid fuel	
50 - 500	600	50 - 100	90 - 300
> 500	200	100 - 300	100 - 200
		> 300	90 - 200
		liquid fuel	
50 - 500	450	50 - 100	150 - 450
> 500	200	100 - 300	50 - 200
		> 300	50 - 150
		gaseous fuel	
50 - 500	300	Gas Turbines or CCGT without supplementary firing	50 - 90
> 500	200	CCGT with supplementary firing	20 - 90
		gas–fired boiler	50 - 120

We can observe such significant differences in Table III on "*Emission limit values in some permits of large combustion plants with a rated thermal input ≥ 300 MW*".

We can have an evaluation of the potential environmental benefits obtained thanks to more stringent limit values set by IPPC permits by determining the reduction percentage in respect to emission limit values of the previous permits based on the Legislative Decree 152/2006 [8] (Fig. 2, 3, 4).

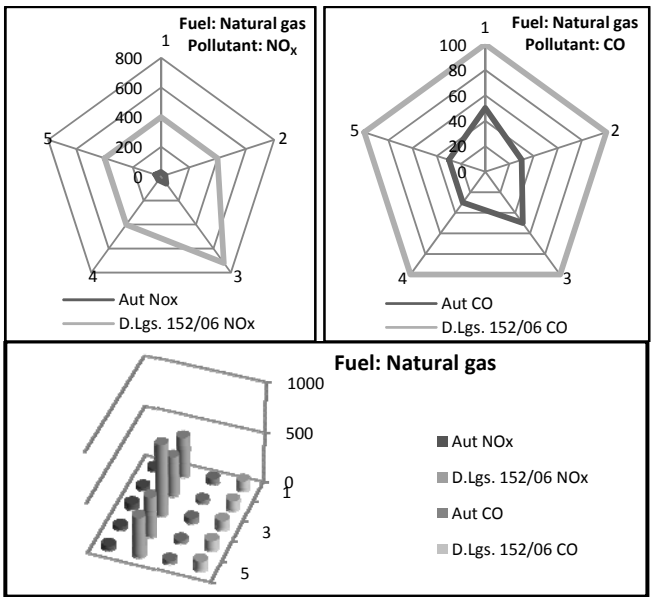

Fig. 2 Potential reduction percentage of emission levels achieved with the AIA permits for plants using gas fuel listed in table III (data source [10] data processing CNR-IIA)

TABLE II
EMISSION LIMIT VALUES (mg/Nm^3) FOR DUST SET BY LEGISLATIVE DECREE 152/06 FOR AN EXISTENT COMBUSTION PLANT WITH A RATED THERMAL INPUT ≥ 50 MW AS COMPARED WITH THOSE ASSOCIATED WITH THE BAT OF BREF FOR LARGE COMBUSTION PLANTS

Legislative Decree no. 152/06		BRef for Large Combustion Plants	
Capacity (MWt)	**Limit value mg/Nm^3**	**Capacity (MWt)**	**Limit value mg/Nm^3**
		solid fuel	
50 - 500	50	50 - 100	5 - 30
> 500	50	100 - 300	5 - 25
		> 300	5 - 20
		liquid fuel	
50 - 500	50	50 - 100	5 - 30
> 500	50	100 - 300	5 - 25
		> 300	5 - 20

TABLE III
EMISSION LIMIT VALUES IN SOME PERMITS OF LARGE COMBUSTION PLANTS WITH A RATED THERMAL INPUT ≥ 300 MW

Rif	**Type**	**Fuel**	**Capacity (MWt)**	**Limit of AIA permit (Limit of D.Lgs. 152/06) mg/Nm^3**			
				NO_X	**SO_2**	**CO**	**Dust**
1	combustion plant	coal	G1 + G2 ≈ 400 each one	200 (600)	200 (800)	30/50 (250)	20 (50)
2	CCGT	NG	≈ 700	30 (400)	-	50 (100)	-
3	combustion plant	oil	4 units 3200 in all	150 (200)	200 (400)	50 (250)	20 (50)
4	combustion plant	oil	G1 + G2 200 each one	200 (450)	250 (1700)	50 (250)	25 (50)
5	CCGT	NG	G1 + G2 1500 in all	30 (400)	-	30 (100)	-
6	CCGT	NG	G1 + G2 635 each one	60 (720)		50 (100)	
	combustion plant	coal	G3 1540	180 (200)	180 (400)	150 (250)	15 (50)
7	combustion plant	coal	G3 + G4 400 each one	200 (600)	200 (800)	50 (250)	20 (50)
	combustion plant	coal	G5 858	90 (200)	80 (400)	120 (250)	10 (50)
8	combustion plant	coal	3 units 4260 in all	80 (200)	80 (200)	120 (250)	8 (30)
9	CCGT	NG	3 units 685 each one	30 (400)	-	30 (100)	-
10	CCGT	NG	2 units 645 each one	40 (400)	-	30 (100)	-
11	combustion plant	oil	2 units 417 each one	100 (450)	200 (940)	50 (250)	20 (50)
	combustion plant	oil	2 units 798 each one	150 (200)	200 400)	50 250)	20 (50)

The operational conditions set in the IPPC permits are also based on the regional plans and programmes, as the air quality plans, which could lead to stricter permit conditions. Indeed, the article 18 of the European directive 2010/75/UE [1] says that "*Where an environmental quality standard requires stricter conditions than those achievable by the use of the best available techniques, additional measures shall be included in the permit, without prejudice to other measures which may be taken to comply with environmental quality standards*".

Therefore, at the end to reduce the emissions at source, the air quality plans are binding also to set the emission limit

values in the IPPC permits, which cannot be less strict than those defined by the local regulations.

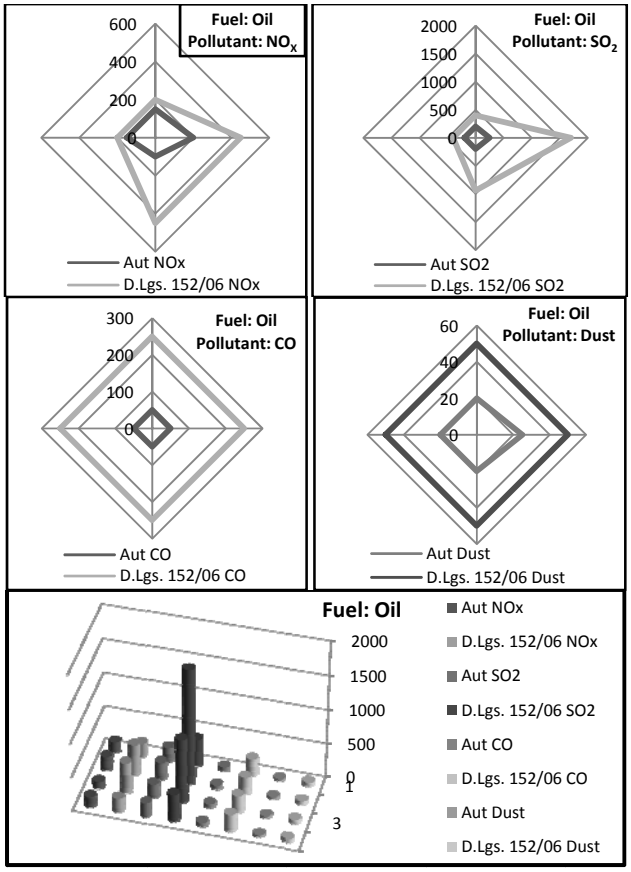

Fig. 3 Potential reduction percentage of emission levels achieved with the AIA permits for plants using liquid fuel listed in Table III (data source [10] data processing CNR-IIA)

For example, it is relevant the case of a coal combustion plant for which the air quality plan stated, as implementation measures for the reduction of emissions from stationary sources, the decommissioning of the plant. In accordance with the regional planning document and the regional advice expressed during the IPPC technical procedure, the first IPPC permit, for the above mentioned combustion plant, stated an adaptation to best available techniques or the decommissioning of the installation. Since the operator did not intend to adopt measures required to adapt the installation to the BAT, the IPPC permit update has regulated the progressive decommission of the all units of the installation. This decommission will end on 2017.

V. Conclusion

The regional plans of air quality represent a relevant instrument to determinate and to attribute the emissive contributions to pollution level of ambient air in a specific territory with exceedances of limit values for a given pollutant and to set out appropriate measures to improve the environmental conditions. The air quality plans might be prepared or implemented in respect of several pollutants and therefore, where appropriate, these plans should be integrated, covering all pollutants concerned.

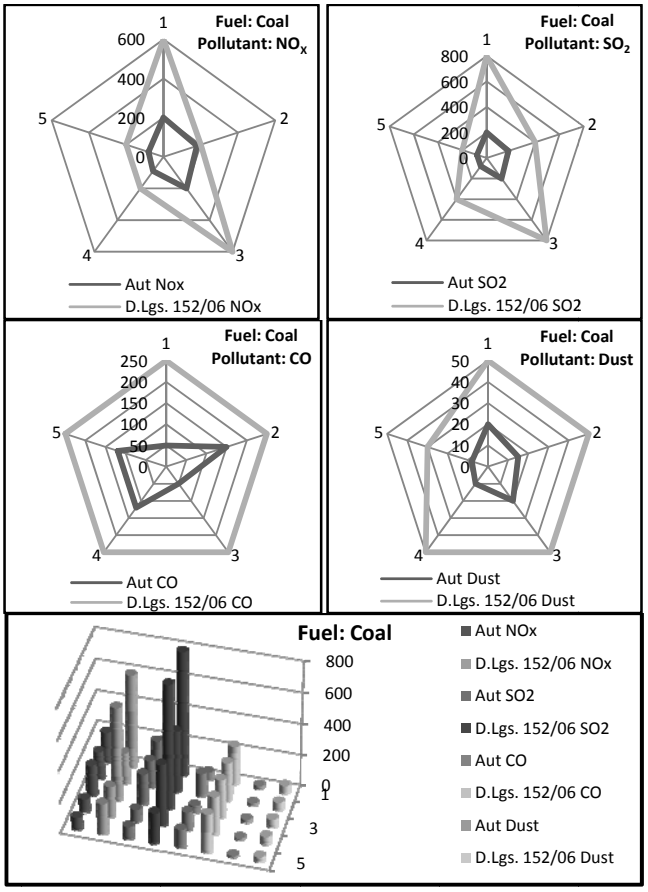

Fig. 4 Potential reduction percentage of emission levels achieved with the AIA permits for plants using solid fuel listed in Table III (data source [10] data processing CNR-IIA)

Therefore, an efficient mean to assess the possible contributions to pollutants from industry and also to individuate the correct approach to achieve the related limit value or target value is the regional air quality plans.

As stated above the IPPC permits might became a valid tool both to enhance the environmental framework and to achieve the standards fixed for the air quality.

This direct connection between the two laws on air quality and IPPC is fundamental in the "areas with a high industrial concentration", where the contribution of the industry to the air quality is significant.

As explained, the issue of IPPC permits created a relevant cut of the industrial emission levels; this decrease should produce an air quality improvement in the plant area. In the near future, thank to the release of new BRefs, currently under revision, there might be a further improvement of the emission framework, due to a stricter emission limit values which will lead to an additional reduction of the pollutants generated by different industrial activities.

REFERENCES

[1] Directive 2010/75/UE of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).
[2] Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 on integrated pollution prevention and control (modification).
[3] Directive 1996/61/EC of the European Parliament and of the Council of 24 September 1996 on integrated pollution prevention and control.
[4] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008on ambient air quality and cleaner air for Europe.
[5] Legislative Decree No 59 of 18 February 20052014 - Implementation of Directive 1996/61/EC.
[6] Legislative Decree No 46 of 4 March 2014 - Implementation of Directives 2010/75/UE - Amending and supplementing Legislative Decree No 152 of 3 April 2006.
[7] Legislative Decree No 155 of 13 August 2010 - Implementation of Directives 2008/50/CE.
[8] Legislative Decree No 152 of 3 April 2006 - Environmental Rules.
[9] Reference Document on Best Available Techniques for Large Combustion Plants - July 2006.
[10] www.aia.minambiente.it