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The Italian inspection system of Seveso and Industrial Emission Directive installations: common points and importance of collaboration

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This paper aims to highlight comparison, overlaps and points in common among the industrial installations in Italy covered by the Seveso Directive and the Industrial Emission Directive.
The main improvements and innovations obtained through the implementation of these Directives into the national legislation are identified. A detailed description of the typology and the quantity of the industrial installations, referred to the last available data, is presented along with the number of inspections carried out and the type and number of cases of non-compliance detected. The paper intends to focus on the inspection systems, human and economic resources involved, performance indicators and environmental objectives to comply, to understand how the main Italian inspection system can guarantee an effective control action. Furthermore, several technical issues related to the storage tanks in oil refineries installations are examined such as: the floating roof sinking, the waterproofing of the containment basins, the double bottom of the tanks and the possible leakage from the bottom of the tank. The evaluations on the application of the Safety Management System and the Best Available Techniques put in evidence the close cooperation and relationship needed in the inspection system, in technical and managerial terms, to fulfil both Seveso and Industrial Emission Directive requirements.
The main outcome of this analysis is that the Italian inspection system seems to be consistent and effective also thanks to the transversality of many aspects required by both regulations, which are all considered during inspections, although with different approach, to have a complete vision of the critical points. The added value obtained through the double-cross control made by the inspectors is the importance of communication among the authorities, in the respect of both safety and environmental issues.

Keywords: compliance, control, Industrial Emission Directive, industrial installations, inspections, Seveso

1. Introduction

The Seveso directive (EC, 2012) establishes that operators must take all necessary measures (both technical and organizational) to prevent major accidents and limit their consequences. To ensure the achievement of this goal, the Seveso directive fixes several requirements that specifically address the assessment and management of hazards and risks, emergency planning, land use planning, inspections, information to the public and the accident analysis, investigation and reporting. The Seveso directive is widely considered as a benchmark for industrial accident policy and has been a role model for legislation in many countries worldwide.
The Industrial Emission Directive (IED) (EC, 2010) is the main instrument regulating pollutant emissions from industrial installations.
IED installations are required to operate in accordance with a permit granted by the competent authorities in the Member States.
The permit should contain conditions set in accordance with the principles and provisions of the IED directive.
Considering that several Seveso installations in Italy are also under IED regulation, Seveso-IED regulations seem to have important common points to highlight. Not only regarding the aim (the protection of environment) but also some focal issues like inspection systems, human and economic resources involved and performance indicators. It is important to understand how the control is guaranteed and how the main Italian inspection system works in these industrial sites, also considering the number of inspections carried out by the inspectors and the type and number of cases of non-compliance detected.

2. National legislation regarding Seveso and IED

2.1. Italian implementation of Seveso Directive

The main innovations obtained through the implementation of the Seveso Directive into the Decree Law No. 105/2015 regard:

- a new unified format for notifications to be sent by the web application SEVESO III.0;
- a complete and elaborated document containing Major Accident Prevention Policy (MAPP) and Safety Management System (SMS) framework plus link to SMS procedures, SMS implementation improvement plan has been introduced;
- a constant and continuous attention for land use planning (LUP) control;
- an External Emergency Plan (EEP) for upper-tier and lower-tier establishments, for the measures to be taken outside the establishments;
- planning and execution criteria for SMS inspections and cooperation and coordination with IED inspections;
- new criteria of identification for all lower-tier and upper-tier establishments with possible domino effects, also for information exchange among operators;
- analysis criteria of Safety Report (SR).

The main actors involved in the Seveso activities regulation and controls are:

- Ministry of environment and energy security (MASE) as the national competent authority for regulatory coordination and monitoring, information exchange with European Commission;
- Ministry of interior as the competent authority for the upper-tier installations inspections and SR analysis;
- ISPRA as the national institute for environmental protection and research for the technical support to MASE, for the notifications' analysis and update of the SEVESO III database, for providing national inspections plan for upper-tier installations and to guarantee homogeneous implementation of Decree Law No. 105/2015 all over the country.
- Regions and local environmental agencies (ARPA) as the local competent authorities for the lower-tier installations inspections;
- Prefects as the local competent authorities for providing the EEP;
- Municipalities as the local competent authorities for land use planning control and for public consultation.

2.2. Italian implementation of IED

The main innovations obtained through the implementation of the IED into the Decree Law No. 46/2014, that modified the Decree Law No. 152/2006, have been the following:

- new categories of production activity subject to Integrated Environmental Authorization (IEA);
- emission limit values established on the basis of the Best Available Techniques (BAT) used for each category of activity and for each type of pollutant;
- regulation of control activities with the definition of the principles for carrying out ordinary inspections based on:
  - frequency, which must be proportional to the company's risk;
  - time period between two site visits, which must not exceed one year for installations with higher risks, three years for installations with lower risks, six months from the last inspection in the event of a serious non-compliance of the permit conditions.

The main actors involved in the IED activities regulation and controls are:

- MASE as the national competent authority for granting the permit of national level installations;
- Regions and provinces as the local competent authorities for granting the permit of regional level installations;
- ISPRA as the control authority for inspections of national level installations and for the technical support to MASE;
- ARPA as the local control authorities for inspections of regional level installations.

3. Seveso and IED industrial installations – typologies and inspections

3.1. Seveso industrial installations

Table 1 shows the total number of Seveso installations in Italy in year 2020 (985) of which 477 are lower tier and 508 are upper tier installations. In figure 1 the distribution of the Seveso installations in each Region of Italy can be observed. The source is the national database of Seveso installations as well as the information exchanged and compared with some regions, ARPA and regional technical committees of the national fire fighters.

Table 1. Number of Seveso installations, divided in upper tier and lower tier, in each region of Italy (year 2020)

Region	Lower tier installations	Upper tier installations	Total
Abruzzo	12	10	22
Basilicata	3	6	9
Bolzano	5	0	5
Calabria	10	6	16
Campania	53	22	75
Emilia Romagna	30	53	83
Friuli Venezia Giulia	14	14	28
Lazio	27	30	57
Liguria	8	20	28
Lombardia	124	136	260
Marche	7	7	14
Molise	3	5	8
Piemonte	35	44	79
Puglia	17	15	32
Sardegna	12	24	36
Sicilia	28	33	61
Toscana	28	28	56
Trento	4	2	6
Umbria	10	5	15
Valle d'Aosta	5	1	6
Veneto	42	47	89
Total	477	508	985

The largest number of Seveso installations are in Lombardy region, where there are 124 lower tier and 136 upper tier installations, equal to 13% and 14% respectively of the total number of Seveso installations in Italy.

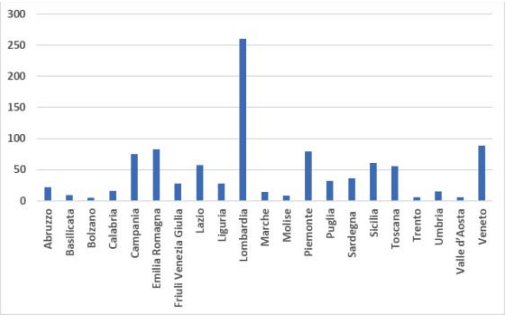

Fig. 1. Total number of Seveso installations in each region of Italy (year 2020)

3.2. IED industrial installations

Table 2 shows the total number of IED installations in Italy in year 2020 (6546) of which 149 are national level and 6397 regional level installations.

Table 2. Number of IED installations, divided in national and regional level, in each region of Italy (year 2020)

Region	National level	Regional level	Total
Abruzzo	5	149	154
Basilicata	0	52	52
Bolzano	0	28	28
Calabria	6	39	45
Campania	7	224	231
Emilia Romagna	18	883	901
Friuli Venezia Giulia	4	226	230
Lazio	6	153	159
Liguria	3	63	66
Lombardia	17	1868	1885
Marche	2	190	192
Molise	2	24	26
Piemonte	11	552	563
Puglia	14	150	164
Sardegna	11	67	78
Sicilia	20	105	125
Toscana	12	324	336
Trento	0	38	38
Umbria	1	129	130
Valle d'Aosta	0	5	5
Veneto	10	1128	1138
Total	149	6397	6546

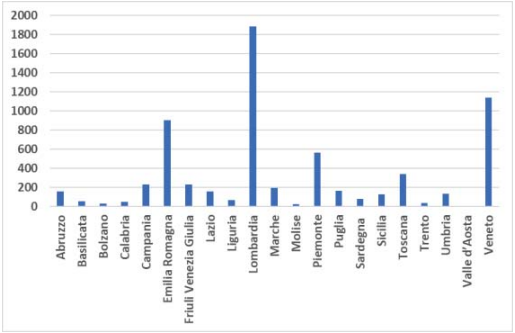

Fig. 2. Total number of IED installations in each region of Italy (year 2020)

In figure 2 the distribution of the IED installations in each region of Italy can be observed.
The source is the SNPA network system (ISPRA and regional environmental agencies).
The largest number of IED installations are in Lombardy region (1868) equal to 28,5% of the total number of installations, followed by Veneto region (1128) and Emilia-Romagna (883), equal to 17% and 13,5% respectively of the total number of IED installations.

3.3. Seveso and IED inspections

In this paragraph, data on inspections carried out by the SNPA network system on industrial installations, in compliance with the IEA and the Seveso Directive for installations at Risk of Major Accident, are provided (SNPA, 2022).
In 2020, despite the lockdown situation due to the COVID 19 pandemic, about 1469 inspection visits were carried out on 6546 IED installations, with a control percentage equal to 22%.
Seveso inspections were 100 in 2020 on 477 lower tier installations and 107 on 508 upper tier installations, with a control percentage of 21% in both cases.

3.3.1. Seveso inspections data and cases of non-compliance detected

Seveso inspections are planned, scheduled and carried out based on the criteria and methods set out in the Decree Law No. 105/2015. In the inspection plan there are also the provisions regarding the cooperation among the different authorities carrying out inspections, with regard to IED control.
Concerning the inspection results, in figures 3 and 4 the main type of non-compliance, major and minor respectively, detected during the inspections performed in year 2020 are shown. They refer to the eight fundamental elements of the SMS, structured according to the contents of the Decree Law No. 105/2015 and namely:

1. Document on the prevention policy;
2. Organization and personnel;
3. Identification and assessment of relevant hazards;
4. Operational control;
5. Modifications and design;
6. Contingency planning;
7. Performance control;
8. Control and revision.

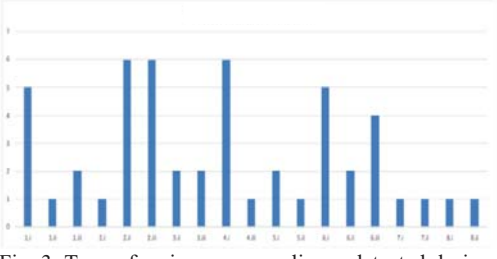
Fig. 3. Type of major non-compliance detected during year 2020 in Seveso inspections

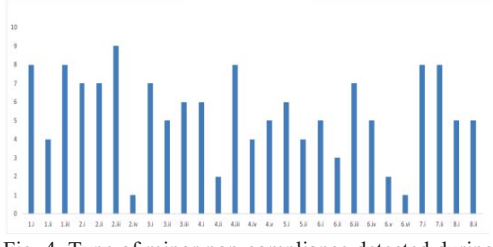
Fig. 4. Type of minor non-compliance detected during year 2020 in Seveso inspections

The main non-compliance (major and minor) have been found for the following elements:

- the policy document (point 1);
- corporate organization and information, personnel training and education (point 2);
- risk identification and improvement actions (point 3);
- operational control (point 4);
- emergency planning (point 6);
- performance monitoring and accident analysis (point 7).

3.3.2. IED inspections data and cases of non-compliance detected

IED inspections are planned according to a control support system based on the Integrated Risk Assessment Method (IRAM) developed by the European Union Network for the implementation and enforcement of environmental law (IMPEL, 2012). During year 2020, 1469 inspections have been carried out among which 75 at national level installations and 1394 at regional level installations.

Regarding the inspection results, in figures 5 and 6 the number and type of non-compliance, at national and regional level respectively, detected during the inspections performed in year 2020 are shown. On a total amount of 712 non-compliance, equal to about 10% of IED installations, the main administrative offence has been found in the category 6 "other activities" listed in Annex I of the IED, while the main criminal offence has been detected in the category 5 "waste management" listed in Annex I of the IED.

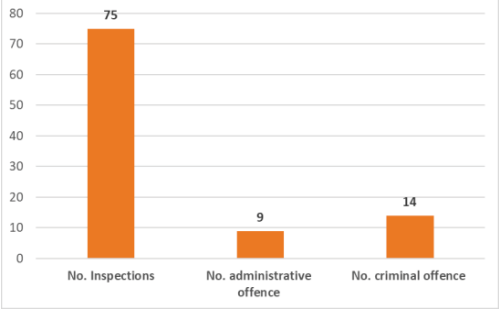

Fig. 5. Type of non-compliance detected during year 2020 in IED inspections at national level installations

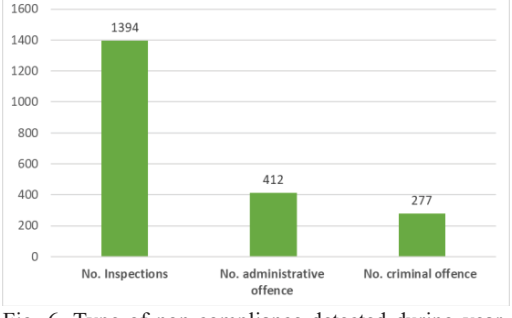

Fig. 6. Type of non-compliance detected during year 2020 in IED inspections at regional level installations

4. Seveso and IED industrial installations – common elements and objectives

More than 7500 industrial installations in Italy are at least covered by Seveso or/and IED controls (985 Seveso and 6546 IED).

The number of installations subject to the above Regulations are significantly different:

- Seveso upper-tier (508), much greater than IED national level installations (149);
- Seveso lower-tier (477), much lower than IED regional level installations (6397).

Anyway, inspections are guaranteed by at least one of the control authorities (many installations uncovered by Seveso are covered by IED and vice versa). Several Seveso installations are also IED national level installations, considering that most of the IED national installations are subject to Seveso too.

Another common issue is the aim, namely the protection of environment, with different point of view:

- IED: reducing harmful industrial emissions into the environment (air, water, underground) through better application of BAT, during normal operating conditions of the installation;
- Seveso: prevention of major accidents which might result from certain industrial activities and limitation of their consequences for human health and the environment, by adopting SMS.

A third common point concerns the reporting, analysis and communication of accidents to the authority:

- IED: operators perform technical analysis and pay attention to diffused and fugitive releases. Furthermore, they are obliged to inform ISPRA in case of accidents, loss of containment to the environment, potential precursors for major-accident;
- Seveso: operators are obliged to analyse the accidents occurred identifying the root causes and the management faults.

The main common point is the inspection activity, even if the approach is different since an IED control should check the prescriptions written in the IEA permit while a Seveso control should perform a SMS inspection according to specific and detailed procedure.

Nevertheless, equipment/system maintenance, accidents control, operative control, technical measures to prevent environmental and safety risk are analysed in similar way.

Concerning the last topic, in the next paragraph one of the main practical issue faced during both Seveso and IED inspections is presented, namely the technical measures or barriers to be adopted by the operator to prevent environmental and safety risk.

5. Practical cases: topics analysed under both Seveso and IED point of view

According to Seveso Directive, the operators are obliged to take all necessary safety technical and management measures (STMM) to prevent major accidents and to limit their consequences for human health and the environment.
According to IED Directive, BAT are advanced and proven techniques for the prevention and control of industrial emissions and the wider environmental impact caused by industrial installations, which are developed at a scale that enables implementation under economically and technically viable conditions. The above-mentioned measures and techniques are selected, analysed and adopted by the plant operator and verified, in technical and managerial terms, by control authorities during both Seveso and IED inspections, although with different approaches.
Practical examples of STMM and BAT referring to critical equipment and systems related to the storage tanks in oil refinery installations are provided in the below tables. They show a comparison, for the specific case of hydrocarbon tanks, among several SMS elements of the check-list used in Seveso inspections (which refers to the STMM to be adopted) and some BAT for emissions from storage (EC, 2006) and for the refining of mineral oil and gas (EC, 2014).
The examined issues are related to the floating roof sinking, the waterproofing of the containment basins, the double bottom of the tanks and the possible leakage from the bottom of the tank.

Table 3. STMM and BAT for plant design, installation and commissioning

Seveso – STMM (reference to inspection check-list)	**IED – BAT (reference to EC 2014)**
3.i – Definition of safety criteria and requirements. Acquisition and updating of design criteria for safety installations and systems. Definition of safety criteria and requirements in compliance with the general and specific objectives indicated in the company policy; their revision and verification also following changes in regulations, operating experience and the state of knowledge.	**BAT 18** – Plant design: limit the potential sources of emissions; maximize the inherent characteristics of process containment; choose high integrity equipment; facilitate monitoring and maintenance activities, ensuring access to potentially leaking components. Plant installation and commissioning: Adopt well-defined procedures for construction and assembly; adopt valid commissioning procedures service and delivery to ensure that the system is installed in accordance with the design requirements.

Table 4. STMM and BAT for plant operation and emission control

Seveso – STMM (reference to inspection check-list)	**IED – BAT (reference to EC 2014)**
3.ii – Identification of possible events and safety analysis – criteria must be defined for the identification and evaluation of dangerous events **4.i** – Identification of installations and equipment subject to control plans – criteria adopted to identify the critical elements of the plant must take into account the assessment of the dangers and the reality of the plant. Operator must systematically identify the critical components, on the basis of the criterion adopted. Critical elements identified must be included in the periodic maintenance, inspection and control programmes, in relation to their reliability, as assumed in the risk assessment, or their life time or failure	**BAT 18** – Operation of the installations: Using a risk assessment-based leak detection and repair program (LDAR) to locate leaking components and repair them.

frequencies, specified by the supplier or established on the basis of operating experience, and the results of previous checks, have to be adopted.	

Table 5. STMM and BAT for control/reduction of atmospheric emissions

Seveso – STMM (reference to inspection check-list)	IED – BAT (reference to EC 2006 and EC 2014)
3.ii, 4.i – see table 4. **3.iii** – Planning of plant and management adjustments for risk reduction and updating. Objectives, targets and programs for reducing the risks of major accidents must take into account both the plant engineering aspects and the organizational or procedural ones, as a result of the safety analysis for the prevention of major accidents. Planning of risk reduction activities must be carried out also taking into account: - the specific relevance of the risk; - the objectives and safety criteria adopted; - operational experience acquired; - the trend of the identified performance indicators. **4.iii** – Operating procedures and instructions in normal, abnormal and emergency conditions. Operating procedures and instructions must be consistent with the safety analysis and must contain, at least, the following information: - operating methods of the installations in normal, anomalous and emergency conditions; - normal operating parameters of the installations; - maximum operating limits of the installations, consequences and management methods if one operates outside the limits, identification of the critical operating procedures for safety; - start and stop procedures (normal and emergency); - procedures for making installations safe	**BAT 18 EC 2014** – see table 4. **BAT 49 EC 2014** – In order to reduce the emissions of VOCs into the atmosphere from the storage of volatile liquid hydrocarbon compounds, BAT is to use a floating roof tank equipped with high efficiency sealing systems or a fixed roof tank connected to a vapor recovery system. **EC 2006 - FLOATING ROOF TANK.** Apply floating roofs in direct contact (double deck). However, the use of already existing floating roofs not in direct contact (pontoons) is considered BAT. Additional measures to reduce emissions are: apply a float in the splined guide rod, apply a sleeve over the splined guide rod, using "socks". For liquids that contain a high level of particulate matter (e.g. crude oil), it is BAT to keep the substance moving to avoid deposits that would require an additional clean-up step. **EC 2006 - FIX ROOF TANK.** BAT is to fit a steam treatment unit or install an internal floating roof. For tanks of capacity <50 m^3, BAT is to apply a pressure relief valve set as high as possible, consistent with the tank design criteria. The emission reduction associated with BAT is at least 98%. For liquids that contain a high level of particulate matter (e.g. crude oil), it is BAT to keep the substance moving to avoid deposits that would require an additional clean-up step. **BAT 52 EC 2014** – Reduction of VOC emissions during loading and unloading operations with recovery efficiency of at least 95%

Table 6. STMM and BAT for control/reduction of emissions to soil or groundwater

Seveso – STMM (reference to inspection check-list)	IED – BAT (reference to EC 2014)
3.ii, 4.i – see table 4. **3.iii** – see table 5. Requirements including effective operational actions to prevent leakage of environmentally hazardous substances into the soil have to be applied. The operator had to define a timetable with the appropriate measures to reduce the risk of contamination of soil and groundwater, including paving and waterproofing the containment basins of tanks containing hydrocarbons (HC). Priority has to be given to the area most subject to accidental releases of toxic products for the	**BAT 51** – In order to prevent or reduce emissions to the soil or groundwater coming from the storage of volatile liquid hydrocarbon compounds, BAT is to apply one of the techniques among those listed or their combination: a) Maintenance program including monitoring, prevention and control of corrosion. Management system including leak detection and operational controls to prevent overfilling, an inventory control procedure and risk-based inspections

environment, as well as to the basins of petrol storage tanks, since the accidental release of finished and semi-finished products present the greatest risk of environmental contamination in relation to their chemical and physical characteristics. Need to supply the oil products tanks with double bottom and adequate monitoring system of the interspaces. **4.iii** – see table 5.	periodically applied to the storage tanks to verify their integrity, as well as maintenance aimed at improving the containment of the tank itself. b) Double bottom tanks. A second waterproof bottom that provides protection against spills from the first bottom of the tank. Generally applicable to new tanks and after reviewing existing tanks. The technique may not be generally applicable when tanks are intended for products whose handling in the liquid state requires heat (e.g., bitumen), and when losses are unlikely to solidify. c) Waterproof inner lining membranes. A continuous waterproof barrier under the entire bottom surface of the tank. d) Protection basin that ensures sufficient containment of the storage area. The containment area is designed to contain any large spills potentially caused by tank rupture or overfilling (both for environmental and safety reasons). Dimensions and associated building dimensions are generally defined by local regulations

6. Conclusions

In this paper the main innovations obtained through the implementation of Seveso and IED directives into the national legislation have been highlighted as well as the number of the industrial installations, the number of inspections carried out, the type and number of non-compliance detected have been presented.

The analysis carried out showed that, although the number of Seveso and IED installations is significantly different, inspections are guaranteed by at least one of the control authorities since some installations are under both directives.

Some common elements among installations under Seveso and IED as inspection systems, human and economic resources involved, performance indicators and environmental objectives to comply have been presented.

They allowed to highlight how safety and environment aspects meet and need to be integrated to avoid losing important results.

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