INSPECTIONS AND CONTROLS IN SEVESO AND IED ESTABLISHMENTS: POSSIBLE INTEGRATIONS FOR SIMPLIFICATION PURPOSES

Exchanges of multilateral experience Italy/Europe

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Integration between Major Accident Safety Management Systems (SMS) and IED Environmental Management Systems (EMS): key interfaces, overlapping elements, information exchanges

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Introduction

In many industrial installations safety and environmental aspects meet and need to be integrated

Regulations have important common points: not only the aim (the protection of environment) but also focal issues like inspection systems, human and economic resources involved and performance indicators

Seveso Directive (2012/18/EU) on the control of major-accident hazards involving dangerous substances.

IED Directive (2010/75/EU) on industrial emissions (Integrated Pollution Prevention and Control).

Main improvements/innovations through the implementation of Directives into the national legislation and main actors involved

- new unified format for notifications in web application SEVESO III.0;
- a complete document (MAPP + SMS framework + link procedures + actions plan) has been introduced
- 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
- analysis criteria of SR

- MASE: CA for regulatory coordination and monitoring, information exchange with EC
- Ministry of interior: CA for the upper-tier installations inspections and SR analysis;
- ISPRA: 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 DL No. 105/2015
- Regions and ARPA: local CA for the lower-tier installations inspections;
- Prefects: local CA for providing the EEP
- Municipalities: local CA for LUP control and for public consultation

Main improvements/innovations through the implementation of Directives into the national legislation and main actors involved

- new categories of production activity subject to IEA
- emission limit values established on the basis of the 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 1 year for higher risks installations, 3 years for lower risks installations, 6 months from the last inspection in the event of a serious non-compliance of the permit conditions

- MASE: national CA for granting the permit of national level installations
- Regions and provinces: local CA for granting the permit of regional level installations
- ISPRA: CA for inspections of national level installations and for the technical support to MASE
- ARPA: local CA for inspections of regional level installations

1° common point: the aim

The aim: protection of Environment, with different point of view

Seveso Directive (2012/18/EU) prevention of major accidents in industrial activities and limitation of their consequences for human health and the environment, by adopting SMS

IED Directive (2010/75/EU) reducing harmful industrial emissions into the environment (air, water, underground) through better application of BAT, during normal operating conditions of the installation

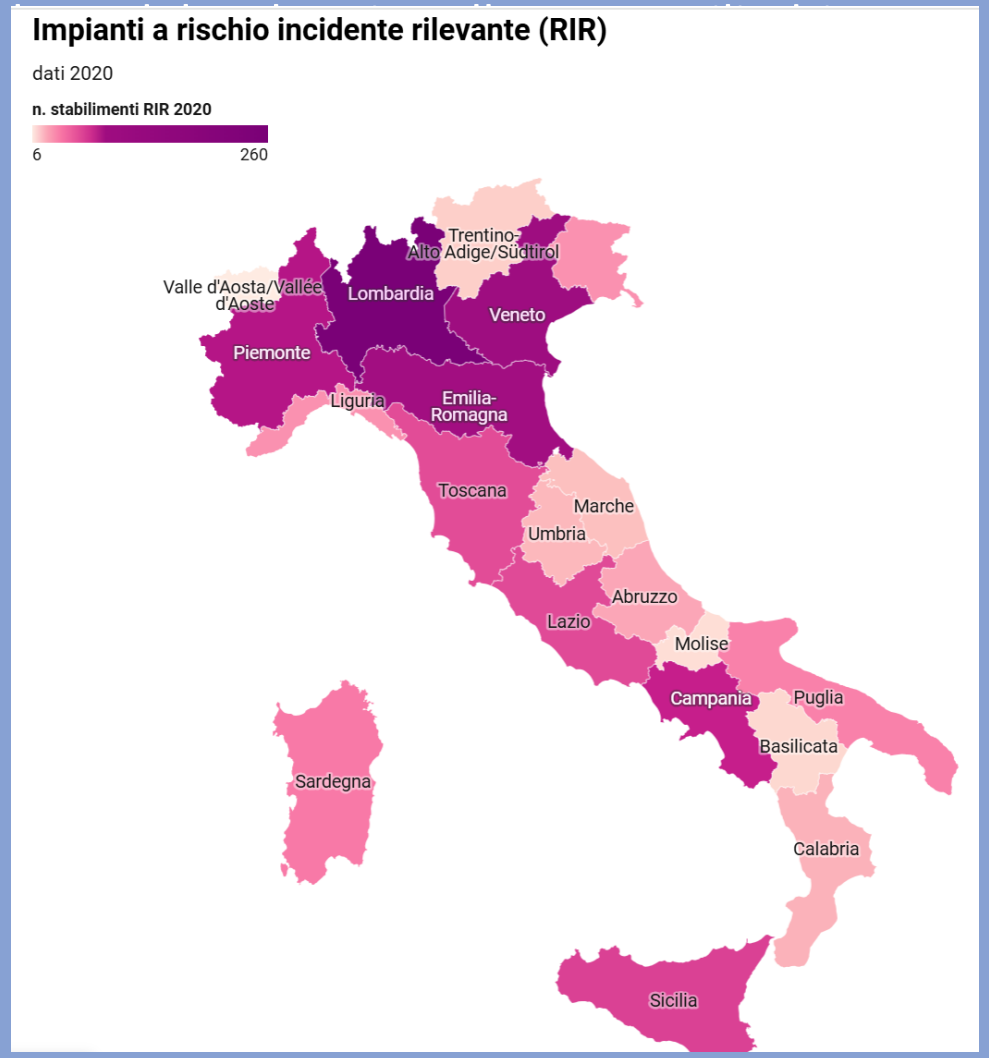
Seveso and IED industrial installations

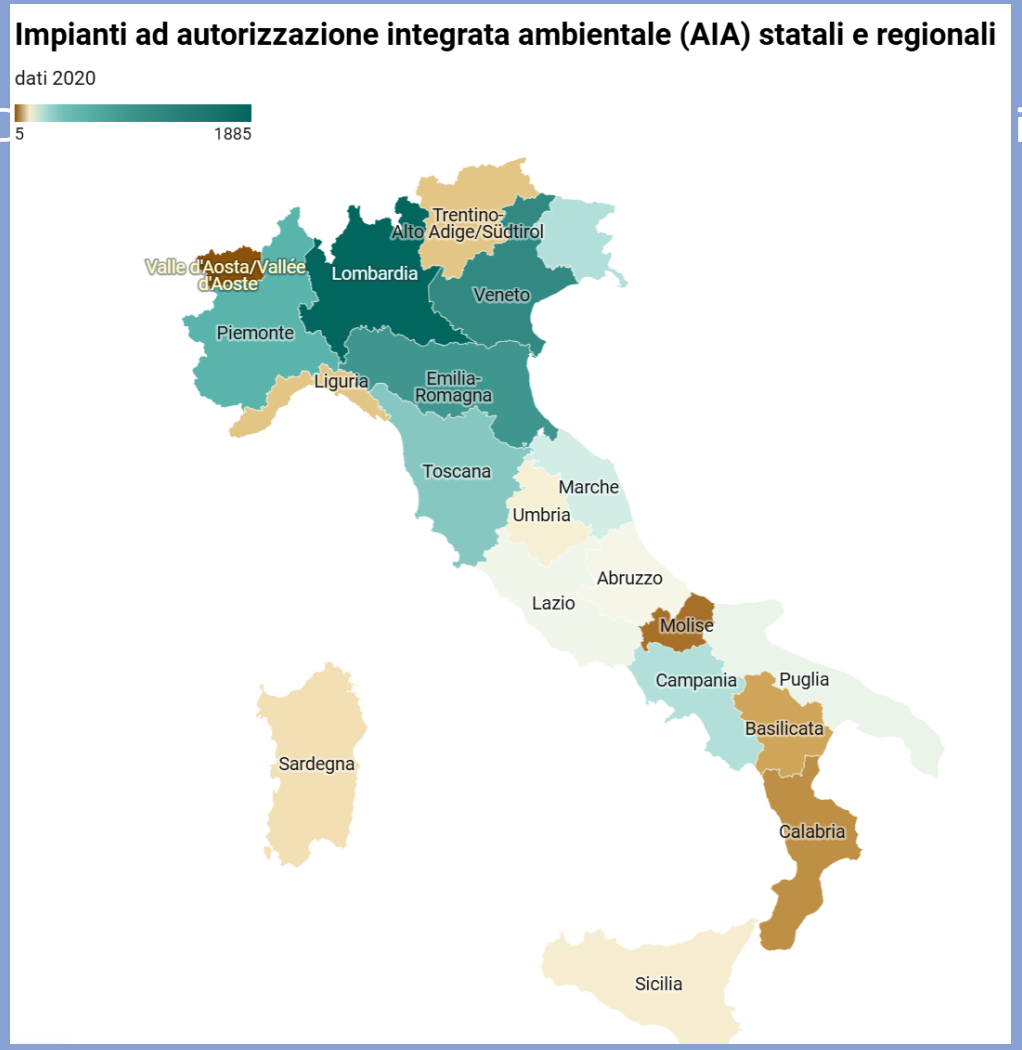
More than 7500 installations are at least covered by Seveso or/and IED controls (975 Seveso and 6500 IED). Significantly different the n. of installations:

- Seveso upper-tier (507), much greater than IED national installations (133);
- Seveso lower-tier (468), much lower than IED regional installations

Inspections are guaranteed by at least one of the CA (many installations uncovered by Seveso are covered by IED and vice versa). Several Seveso installations (almost 50) are also IED national installations (most of the IED national installations are Seveso too)

Seveso and IED industrial installations

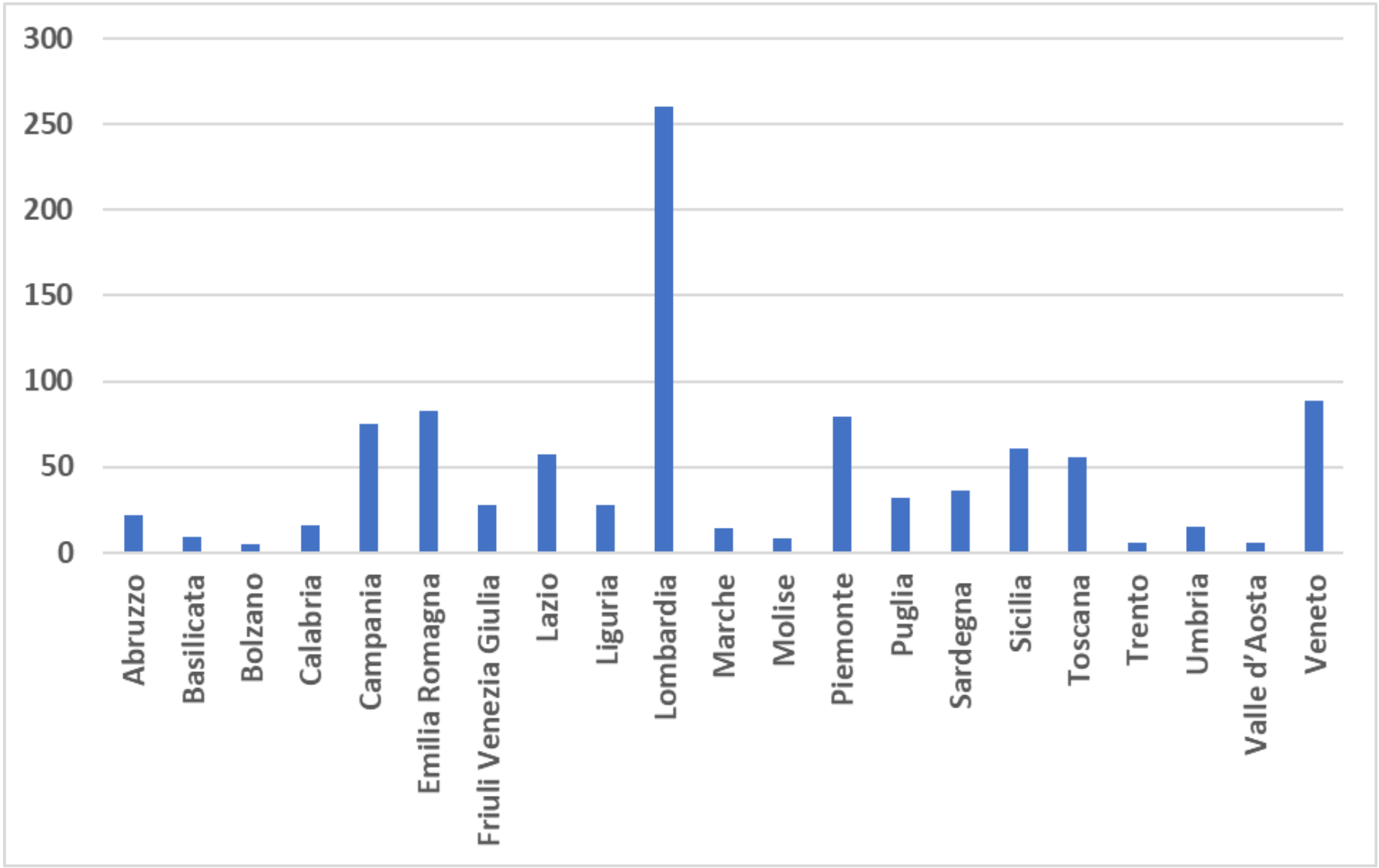




Seveso industrial plants (2024)

Total Seveso plants in Italy: 975.
Distribution of Seveso plants by region

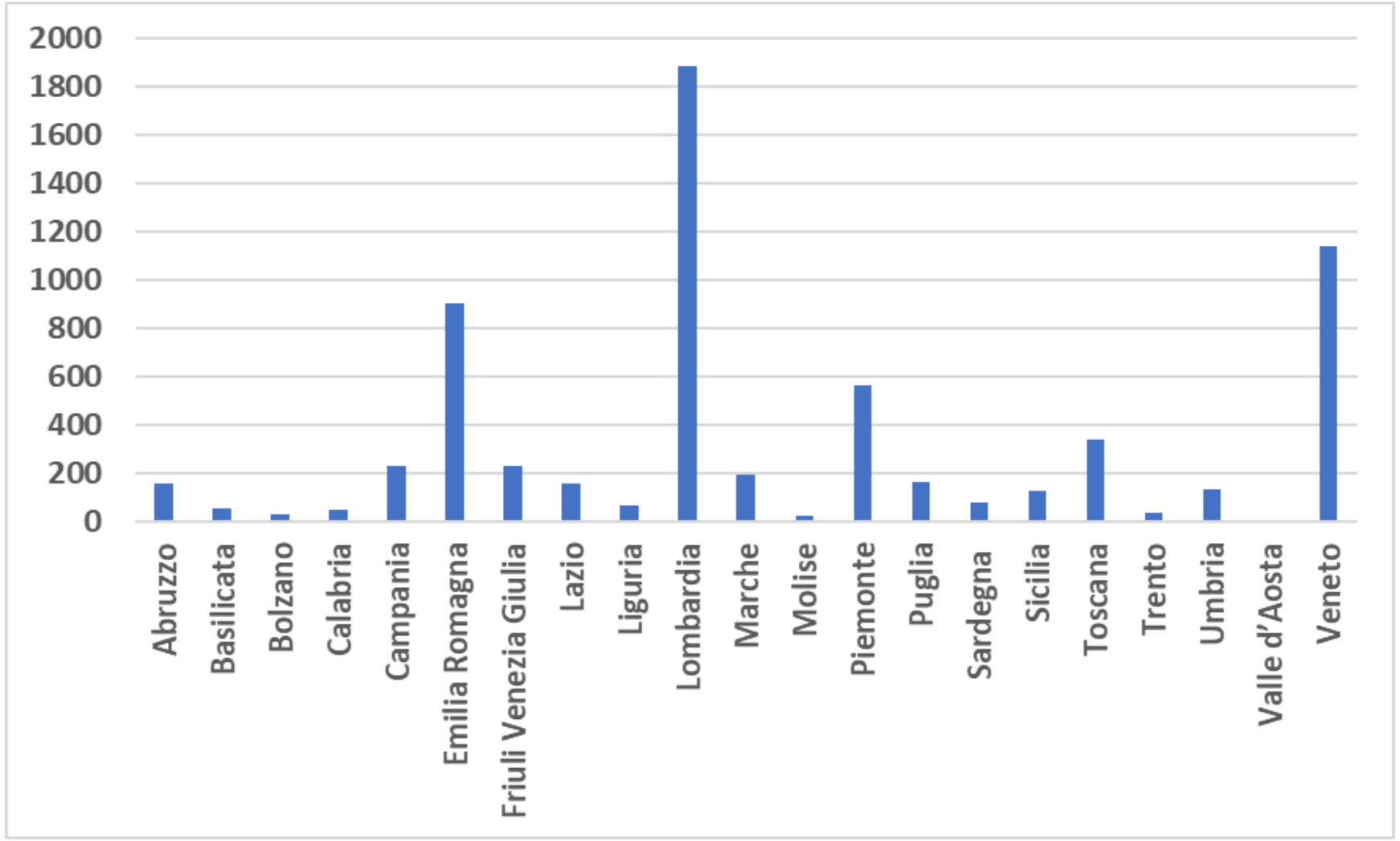
(sources: Seveso notification portal and information exchanged and compared with some regions, ARPA and CTR of the national fire brigade)



IED industrial plants (2024)

Total AIA plants in Italy: approximately 6,500.
Distribution of AIA plants by region

(source: SNPA network (ISPRA and ARPA))



Seveso and IED industrial installations – other common elements

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

Inspections: topics analysed under both Seveso and IED point of view

The measures/techniques are adopted by the plant operator and verified, in technical and managerial terms, by control authorities during both Seveso and IED inspections, with different approaches

Practical examples of STMM/BAT for critical equipment/systems in oil tank storage (refinery installations) show a comparison among several SMS elements of the check-list used in Seveso inspections and some BAT for emissions from storage (EC, 2006) and for the refining of mineral oil and gas (EC, 2014)

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.

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

Seveso and IED inspections harmonization – future perspective

- Considering the common elements highlighted, and the need (according to the Seveso national Decree) for the Ministry of the Interior and the Regions, in collaboration with ISPRA, to ensure the coordination and harmonization of the inspections in the whole country, providing also the coordination with the IED inspections, in 2023 a proposal was made by ISPRA to Ministry of Environment, aimed at the harmonization of planning and carrying out of Seveso and IED inspections in the national level installations
- Considering that ISPRA is the IED control authority for IED national level installations, to ensure the above harmonization it has been proposed to include ISPRA inspectors (with both Seveso and IED qualifications) within the Seveso teams carrying out inspections in IED national level installations. This could ensure, moreover, a link between the two activities both for the technical-operational and organizational-managerial aspects, resulting from IED (environmental) controls and common to Seveso inspections on upper-tier establishments

Seveso and IED industrial installations – other common elements

Other common point: **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.

SEVESO – IED: accidents reporting/analysis

SEVESO

- Seveso Directive 2012/18/UE
- D. Lgs. 105/15
- Aim: prevenire, mediante adozione
- prevent, through the adoption of an adequate SGS, the occurrence of major accidents related to certain dangerous substances and limit their consequences for human health and the environment
- Control of high-risk industrial plants (RIR)
- Managers' obligations: prevention, monitoring, management, mitigation, and reporting of major accidents and more...

IED

- IED Directive 2010/75
- D. Lgs. 152/06 e s.m.i.
- Aim: to prevent and reduce, with an integrated approach and BAT application, industrial pollution of the environment caused by industrial plants in normal operating conditions
- Control of IED industrial plants
- Among the obligations of managers: reporting and managing incidents or unexpected events that significantly impact the environment

SEVESO – IED: accidents (NOT ONLY) reporting/analysis

SEVESO

- Reporting/analysis of operational experience of accidents or near misses involving hazardous substances (Seveso) in RIR facilities
- Identification of root causes related to SGS management elements
- Adoption of lessons learned and development of preventative/ mitigative safety measures
- Dissemination to company personnel and exchange with similar facilities

AIA

- Reporting of incidents, anomalies, malfunctions, or unforeseen events that significantly impact the environment
- Final report with root cause analysis and actions taken to contain the event

This includes unplanned and uncontrolled releases of any hazardous substance (including flammable and toxic substances)

SEVESO – IED accidents analysis: example 1

MARS inspection and IED inspection

- Accident description: slow hydrocarbons release occurred from the tank-bottom of a storage plant: environmental impact
- Accident analysis: interesting critical issues elements, linked to the root-causes of the accident, have been highlighted. Important Safety&Environmental-Management-System improvements have been carried out after Seveso and IED inspections
- Final focus: need to find ways to improve communication between Seveso and IED control activities and to adopt common approaches when dealing with the operation of an establishment in the respect of both safety and environmental issues

SEVESO – IED accidents analysis: example 1

MARS inspection and IED inspection

Accident description

- polluted water with hydrocarbons has been found inside a sewage pipeline of the wastewater treatment plant (WWTP), close to a crude oil extraction/storage plant, during environmental monitoring/control activity of the soil
- following investigations assured that a LOC occurred from the tank-bottom of the storage plant: 26000 m2 area polluted from top surface down to groundwater level, strong environmental impact. Almost 400 tons of crude oil released in the environment
- all plant activities suspended for 90 days; inspections and monitoring phases took place. Slow and long evolution of the event, discovered only after months from the starting of the release, during environmental monitoring/control activity of the soil
- toxic release in underground: not always quickly detectable, the effects magnitude strictly related to the intervention time. No signals before the accident, discovered only through a routine environmental soil control, and after a detailed reconstruction of the facts

SEVESO – IED accidents analysis: example 1

MARS inspection and IED inspection

Accident analysis – Root causes

- failure of the primary protection system of the tank D: damage to the bottom due to a corrosive phenomenon, formation of through-holes and LOC from the tank
- failure of the secondary protection system of the tank D: damage to the asphalt barrier and consequent cracking. The oil vertical migration in the layers below the bottom of the tank was due to the damage of the impermeable layer (bituminous conglomerate barrier) 80 mm thick under the bottom. Cracks might be generated by contact of the less rigid bituminous layer with the annular (rigid) concrete foundation, due to the different behavior of the two materials under stress
- failure of systems to mitigate the event, aimed at signaling the event and the uncontrolled release of hydrocarbons. Long vertical migration of the crude oil into the layers (1-2 m depth) below the bituminous conglomerate barrier, then into the saturated zone (underground aquifer) until the groundwater (at a depth of about 5-6 meters

SEVESO – IED accidents analysis: example 1

MARS inspection and IED inspection

Environmental monitoring/IED inspections

- immediately after the event, safety activities were carried out by the company, under the supervision of environmental Authorities (ISPRA, Region, local agency) through more than 150 survey points, to delimit the area polluted and monitor the quality of the surface water; 5 hydraulic barriers with recovery systems to block the flow of groundwater and avoid the spread of contamination, active until the completion of the soil and aquifer remediation activities
- evironmental investigations-monitoring excluded the contamination of surface water and deep aquifers outside the area where the recovery systems were operating
- Characterization Plan was approved after the event: the activities started in November 2017 and concluded in advance of the expected deadlines
- agreement among ISPRA, Region and local Environmental Protection Agency has been signed to carry out and coordinate environmental monitoring and protection of the site. In this context, ISPRA provided technical support for site inspections and monitoring activities

SEVESO – IED accidents analysis: example 2

Accident reporting by IED industrial plants

30.11.21: Explosion and fire at the Livorno Refinery (IED national plant and Seveso upper tier)

- With note RAF-LI-DIR 61/171 dated November 30, 2021, the Company notified the authorities of the event, as required by the AIA (point 6, Article 4 and provision 33 of the PIC of Ministerial Decree no. 0000032 of February 2, 2018).
- Explosion inside the furnace F2 of the Hot Oil plant. The furnace consisted of 12 burners fueled by methane gas, of which 7 were active at the time of the event.This resulted in a hot oil leak, which immediately ignited and started a fire.
- Around 45 tons of hot oil released, some of which burned in the fire and some flowed, through the sewer system, to the refinery's water treatment plant (ETP), where it was collected in slop tanks for recovery in the production process
- The plant was operating to ensure heating of the heavy product tanks; other adjacent facilities were shut down for scheduled maintenance

SEVESO – IED accidents analysis: example 2

Accident reporting by IED industrial plants

30.11.21: Explosion and fire at the Livorno Refinery (IED national plant and Seveso upper tier)

- Material damage: Furnace F2 completely destroyed, damage to the interconnection lines with adjacent plants. Damage to the SME cabin of adjacent stack 7 (which receives fumes from the hot oil plant), resulting in the unavailability of pollutant measurements (communicated by the operator to the AC).
- The fire generated a dense cloud of black smoke. All refinery personnel, including external contractors, were evacuated
- The plant's Emergency Planning Scheme (PEI) was activated; the Fire Department was called in. The fire was completely extinguished within 45 minutes.
- The furnace area was placed under criminal seizure by the Fire Brigade and Police personnel of the Grosseto NOE.

SEVESO – IED accidents analysis: example 2

Accident reporting by IED industrial plants

SEVESO – IED accidents analysis: example 3

Accident reporting by IED industrial plants

13.11.23: fire at the VERSALIS plant in Brindisi (IED national plant, Seveso upper tier)

- Release (and fire) of 1.5 tons of ethylene, a highly flammable gas (Seveso P2 category), from an 8" bottom line of the V2109 equipment (column), operating normally, in the ethylene purification section of a polyethylene production plant
- Possible cause of the line's loss of containment: rapid-kinetic exothermic chemical reaction, with thermal-pressure stress, and therefore mechanical stress, on the unit and subsequent rupture of the outlet line
- The leak was immediately identified by gas detectors monitoring the unit area, and active protection systems were immediately activated. Automatic deluge systems, process isolation, and the intervention of the company emergency team contained and contained the event, minimizing damage
- No effects on people or the environment

SEVESO – IED accidents analysis: example 4

Major Accident (Seveso) identified during IED inspection

- During ordinary IED inspection of national plant (according with the Article 29-decies, L.D. 152/2006) the accident “cathastrofic failure of an acid solution reactor in the SX plant," notified by the Company to ISPRA, was identified as possible Seveso major accident (under Annex 6, Part I, point 1, of L.D. 105/2015)
- Partial emptying of the reactor, spilling its contents into both the containment basin and the industrial sewer system that conveys the water to the plant's effluent treatment plant
- The hazardous substance involved falls within the Annex 6, Part I, point 1) of L.D. 105/2015, since the quantity of substance released from the reactor (electrolytic solution, notified in category "E2“ - hazard indication H411) is approximately 80 m3 (112 t, above the 5% threshold in Annex 6). Moreover, at the moment of IED inspection, the substance has changed its hazard classification in H410 ("E1" category) which further supports the exceeding the aforementioned 5% threshold

SEVESO – IED accidents analysis: example 5

Seveso Accident (major?) identified after information exchange between IED - Seveso inspection teams

- simultaneous (ongoing) carrying out of the Seveso inspection with the ordinary IED inspection at the same Refinery
- following discussions between Seveso - IED Inspection Teams, a Seveso accident was identified, reported by the operator to the CA only pursuant to art. 242/249 of Legislative Decree no. 152/2006 as an event of potential environmental contamination
- the accident: crude oil spill on the floating roof of the DAX tank, and release of polluting product (crude oil mixed with water/foam) on the adjacent land; citizens of near city reported strong odors of hydrocarbons; preventive seizure of the tank (still in progress) by the local Public Prosecutor's Office, with the intervention of the District Investigative Unit for Environmental and Health Protection (NICTAS) of the Public Prosecutor's Office
- still under investigation …

SEVESO – IED accidents analysis: example 6

Refinery case study: Working Group CTR – Seveso expert – IED expert

- Case study: Italian refinery both Seveso and IED installation.
- The Safety Report analysis suggested to apply appropriate measures to reduce the risk of contamination of soil and groundwater, including paving and waterproofing the containment basins of tanks containing hydrocarbons (HC).
- A Working Group (WG) was created to evaluate and investigate the major accident scenarios concerning the HC storage tanks, comparing and sharing information on the common issues between Seveso and IED.
- The main results of the WG are showed

SEVESO – IED accidents analysis: example 6

Refinery case study: Working Group CTR – Seveso expert – IED expert

Tank overfilling

State of the art

- All storage tanks are equipped with level indicator, high level alarm (HLA) and independent high-high level alarm (HHLA) both reported to the control room.
- Tanks containing benzene hexachloride (BHC) and methyltertbutylether (MTBE) are equipped with an independent high-high level block system.

WG evaluations

- install an automatic HHLA block system for all products tanks. This block should guarantee the automatic shutdown of the pumps and the closing of the tank supply valves
- formalize the procedures for the equipment 'put in safe' after the activation of the HLA and HHLA of the storage tanks
- increase by at least one order of magnitude the frequency of occurrence assumed for the overfilling event (10^{-9}), since the probability of non intervention adopted is less conservative than the one reported in other technical references in literature

SEVESO – IED accidents analysis: example 6

Refinery case study: Working Group CTR – Seveso expert – IED expert

State of the art

In order to comply IED permit condition, the operator produced a report "Risk assessment of soil and groundwater contamination" where:

- risk of soil contamination of the HC containment basins with potential reaching the groundwater was considered
- infiltration of the product was analysed using a Hydrocarbon Spill Screening Model (HSSM) by considering homogeneous categories of product

WG evaluations

- approximation to a single lithological type (sand in this case) for the entire area can lead to unsafe assumptions, especially without experimental data
- 4 levels of consequence severity are defined, in relation to the reaching time of the groundwater, however there are no elements supporting the chosen criteria
- for all products, with the exception of fuel oil, the entity of the impact on soil and groundwater is directly proportional to the quantity of the spilled product

SEVESO – IED accidents analysis: example 6

Refinery case study: Working Group CTR – Seveso expert – IED expert

State of the art

- The operator considered the collection of rainwater from the lateral surface of the tanks and fuel leakage.
- Circular concrete channels for partial waterproofing of the containment basins to contain small product leakage.

Substance	Potential impact
High Benzene Petrol (BHC)	High
Finished petroleum products	High
Semi-finished products	Mid-high
Kerosene	Mid-high
Diesel	Medium
Semi-processed and cyclic diesel	Mid-high
Crude oil	Medium
MTBE	Very high
Fuel Oil	Low

WG evaluations

- In case of very high, high and mid-high impact the prompt removal of the spilled product and saturated topsoil does not prevent the reaching of deep soil and groundwater.
- Circular concrete channels would not mitigate the consequences of the accidental tank overfilling scenario, as these channels are designed for significantly lower flow rates (approximately 1 m^3/h).
- The operator should re-evaluate the sizing of the channels taking into account also the overfilling scenario of the tanks and other accidental scenarios.

SEVESO – IED accidents analysis: example 6

Refinery case study: Working Group CTR – Seveso expert – IED expert

State of the art

- The operator implemented a control program for shell (external visual inspection) and shell & roof corrosion (thickness inspection).
- The hypothesis of significant leakage from a 10 mm diameter hole was developed.
- The flow rate released in this scenario would be a maximum of 1 m^3/h in the case of a hole in the lower part of the shell.

WG evaluations

Substance	Minimum monthly checks	Interval between 2 checks (days)	Flow rate in case of leakage (m3/h)	Intervention time after detecting leakage (hours)	Total spill flow rate (m3)
Petrol	30	1.0	1	24	48
Crude oil	42	0.7	1	24	41
Diesel	13	2.3	1	24	79
Fuel oil	8	3.8	1	24	114

- Considering the worst case (leakage in the lower part of the tank shell), the maximum released flow (1 m^3/h) is well within the volume of the circular channel and would therefore be successfully drained towards the refinery sewage system, recovered and sent to the wastewater treatment plant.

Conclusions (1)

- Although the number of Seveso and IED installations are significantly different, inspections are guaranteed by at least one of the control authorities, and 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, accidents analysis and environmental objectives to comply highlight how safety and environment aspects meet and need to be integrated to avoid losing important results
- Italian inspection system could be consistent and effective also thanks to the transversality of many aspects required by both regulations, which can be all considered during inspections, although with different approach, to have a complete vision of the critical points

Conclusions (2)

- Among different common point, one element of particular importance is: **reporting, analysis and communication of accidents** to the Authority
- Many opportunities for collaboration and interface between SEVESO and IED teams:
  - *MARS inspection - IED inspection*
  - *Accident reporting by IED industrial plants*
  - *Major Accident (Seveso) identified during IED inspection*
  - *Seveso Accident identified after information exchange between IED - Seveso inspection teams*
  - *Working Group CTR – Seveso expert – IED expert*
- All examples of key interfaces and good information exchanges

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Thank you !

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