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Controlling activities in the LPG and LNG sector: findings of safety reports assessments and SMS inspections for some national establishments

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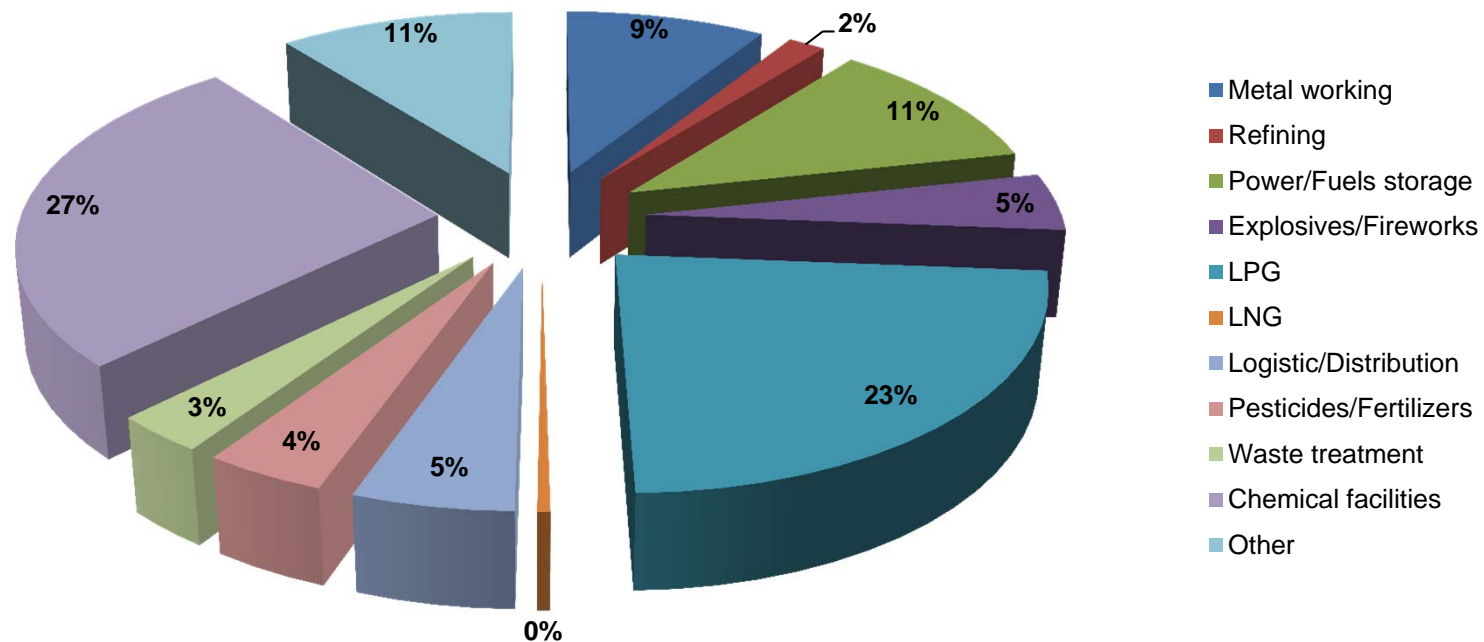
Introduction and Background

The role of ISPRA for industrial risk control

- ▶ ISPRA has a national role as a **technical body supporting the Ministry of Environment** in the national implementing of the **Seveso Directives** (last: D. Lgs. 105/2015)
 - ▶ Definition of **technical contents of laws and decrees** to control Major Accidents
 - ▶ Set-up of the **National Inventory of major accident hazards** establishments and other related data-bases
 - ▶ **Inspections of upper-tier establishments SMS** on regular basis or after an accident
 - ▶ **Support for international activities** (EU, OECD, bilateral cooperation)
 - ▶ Technical coordination and **addressing of Regional Agencies (ARPA)** within the **National System for Environmental Protection (SNPA)**
 - ▶ **Collaboration with other Authorities competent for industrial risk** (Ministry of home affairs – National Fire Brigades; Department of civil protection; Ministry of infrastructures)

LPG and LNG sector: the Italian situation

Seveso Establishments



- ▶ *Italian Seveso establishments: 945 sites*
 - ▶ *LPG production, bottling, distribution and storage: 222 sites*
 - ▶ *LNG storage, re-gasification and distribution: 4 sites*

Establishments of the LPG and LNG sector subject to the analysis: a sample of some national types – 1/4

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- ▶ LPG storage and city distribution (300 t of LPG)
 - ▶ Receiving of LPG by tanker (20 t), carried out by compressors
 - ▶ LPG (propane-butane-mix) storage in mounded tanks
 - ▶ Possibility of LPG mixing through internal transfer of product from one tank to another
 - ▶ LPG vaporization by hot water vaporizers and odourisation
 - ▶ Pressure reduction and city distribution of LPG through pumps

Establishments of the LPG and LNG sector subject to the analysis: a sample of some national types – 2/4

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- ▶ LPG underground storage (22.000 t of LPG)
 - ▶ Receiving of **LPG by refrigerated vessels** (3.000 t – 21.000 t) through on-board pumps
 - ▶ **Heating** and measurement of the product
 - ▶ **LPG storage in underground tanks** (caves in a layer of clay)
 - ▶ **Denaturation and odourisation** of the LPG extracted from underground tanks
 - ▶ Shipping of **tankers (22 t) and railway tanks (45 t)**
 - ▶ **LPG transfer to nearby** establishment

Establishments of the LPG and LNG sector subject to the analysis: a sample of some national types – 3/4

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- ▶ Multi-site LPG storage company (400 t of LPG)
 - ▶ LPG receiving by tanker through compressors
 - ▶ LPG (propane-butane-mix) storage in above-ground mounded tanks
 - ▶ Bottling in LPG cylinders and cylinders maintenance
 - ▶ Shipping of LPG tankers and cylinders by pumps

Establishments of the LPG and LNG sector subject to the analysis: a sample of some national types – 4/4

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- ▶ Offshore LNG storage and re-gasification terminal (120.000 t of LNG)
 - ▶ LNG receiving by refrigerated vessels through on-board pumps and racking arms
 - ▶ LNG cryogenic storage in tanks on a Gravity Based Structure (GBS)
 - ▶ Vaporization of LNG by sea water vaporizers (Open Rack Vaporizers - ORV) and glycol-water exchanger (Waste Heat Recovery - WHR)
 - ▶ Sending and measurement of NG onshore by undersea pipeline (sea-line of 15 km)

**Control activities on the LPG
and LNG sector: Safety
Reports assessments**

Setting-up of the National Inventory of Seveso establishments and SR technical assessment

- ▶ Technical results of the control activities reported in the **inventory of the national establishments** (art. 17 c. 4 D. Lgs. 105/2015)
 - ▶ Taken into account **a sample of 5 Seveso establishments**, of the **LPG and LNG** sector, belonging to the **mentioned types**
- ▶ Information and data about the **findings** that emerged during the last **SR technical assessments by Competent Authorities**
 - ▶ **The examination conclusions** include the technical final **evaluations**, any supplementary **requirements** and, if the measures taken to prevent and limit the consequences of major accidents are insufficient, **the limitation or prohibition of use is foreseen**

Scenarios and damage zones: the sample of establishments

<i>ESTABLISHMENTS</i>	<i>SCENARIOS AND DAMAGE ZONES (m)</i>										
	<i>UVCE (bar)</i>			<i>Flash Fire (-)</i>		<i>Jet Fire (kW/m²)</i>			<i>Pool Fire (kW/m²)</i>		
	<i>I (0.3)</i>	<i>II (0.07)</i>	<i>III (0.03)</i>	<i>I (LFL)</i>	<i>II (½ LFL)</i>	<i>I (12.5)</i>	<i>II (5)</i>	<i>III (3)</i>	<i>I (12.5)</i>	<i>II (5)</i>	<i>III (3)</i>
LPG storage and city distribution				70	110						
LPG underground storage	360	370	450	260	350	150	160	170	70	70	70
Multi-site LPG storage company				70	110	40	50	70			
Offshore LNG storage and re-gasification terminal				290	420	60	100	130	20	40	60

LPG storage and city distribution

- ▶ Plant and structural compliances
 - ▶ Control system of the **tanks static alignment**
 - ▶ **Manual shutoff valves**, upstream of the tank safety valves, which are **freely operable and non-plumbed**
 - ▶ **Double valve on the sample points** of the pipes downstream of tanks
 - ▶ Maintenance interventions on the **tanks covering system**
- ▶ Organizational and management compliances
 - ▶ Communication and alarm **system to ensure the traffic block on the road** (high lethality area)
 - ▶ Emergency procedure for the **introduction of water into the tanks**

LPG underground storage

- ▶ Plant and structural compliances
 - ▶ Technical interventions to improve **safety conditions of the vessel unloading point and the fire control room** at the dock
- ▶ Organizational and management compliances
 - ▶ **Emergency procedure for the vessel unloading point** and connection with local fire brigade
- ▶ Documentary compliances (completeness check)
 - ▶ Qualification and professional **experience of design consultants**
 - ▶ **Seismic analysis** of **underground storage**
 - ▶ **Historical accident analysis** at underground storage sites
 - ▶ **Hazard operability** for the **vessel unloading point**
 - ▶ **Domino effects** on nearby **coastal establishments**

Multi-site LPG storage company

- ▶ Plant and structural compliances
 - ▶ Doubling the connection between the firefighting pumps and the water reserve
 - ▶ Raise the threshold of the room with the electric transformer containing thermal oil
- ▶ Documentary compliances (completeness check)
 - ▶ Deepening the presence of all vulnerable elements around the establishment
 - ▶ Correct location referencing of source points of the accident scenarios with impact outside the establishment

Offshore LNG storage and re-gasification terminal

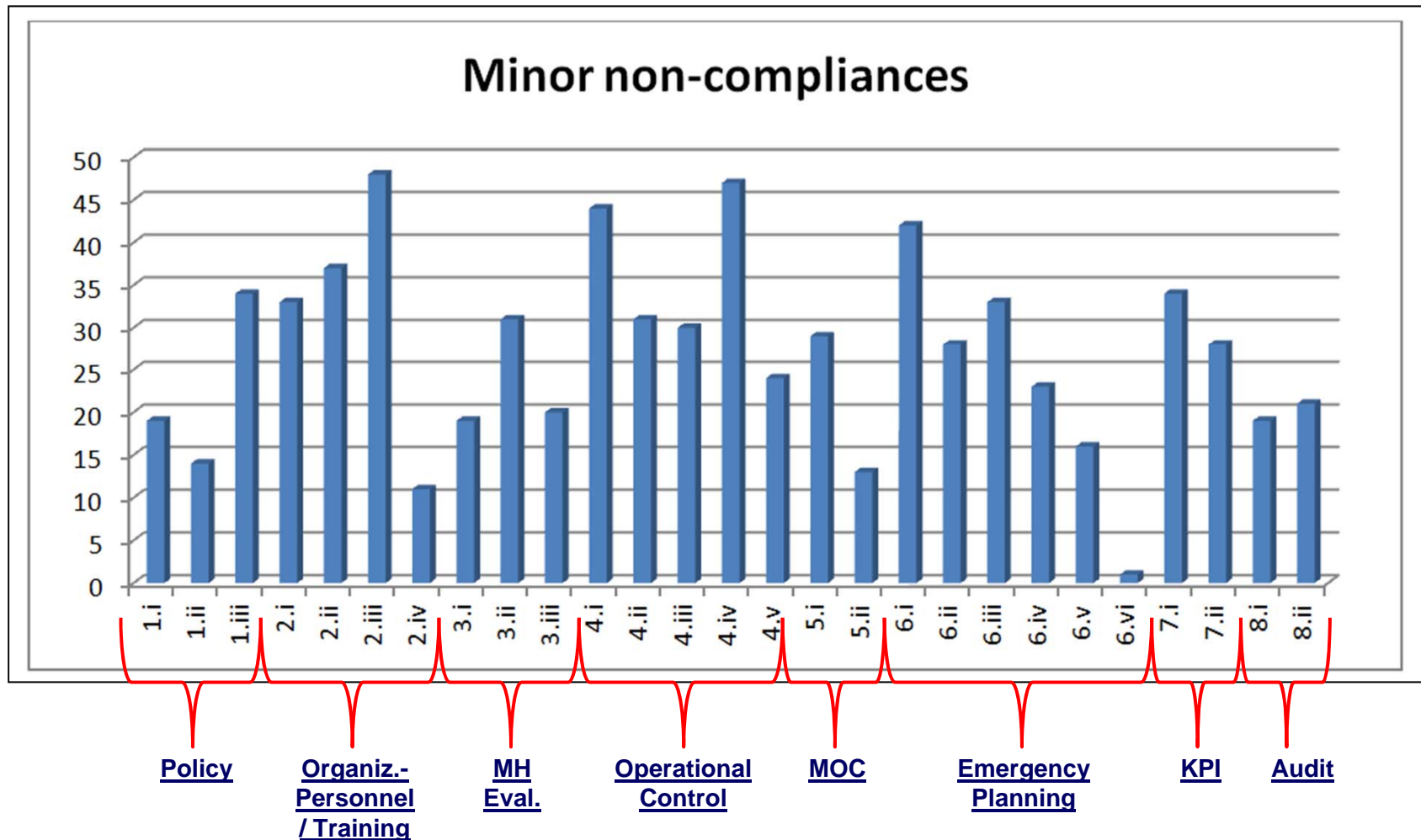
- ▶ Plant and structural compliances
 - ▶ Restoring the safety locks of the Boil Off Gas crane
- ▶ Organizational and management compliances
 - ▶ Computerized controls of the calibration of the flammable fuel tank detectors
 - ▶ Training activities of fire-fighting personnel employed in the helipad
- ▶ Documentary compliances (completeness check)
 - ▶ Technical documentation relating to filter anchorages of the fire-fighting sea water
 - ▶ Possible effects on the risk scenarios associated with the “Low Send-out” speed to the national gas network

**Control activities on the LPG
and LNG sector: Safety
Management System
inspections**

Technical results of Seveso establishments SMS inspections

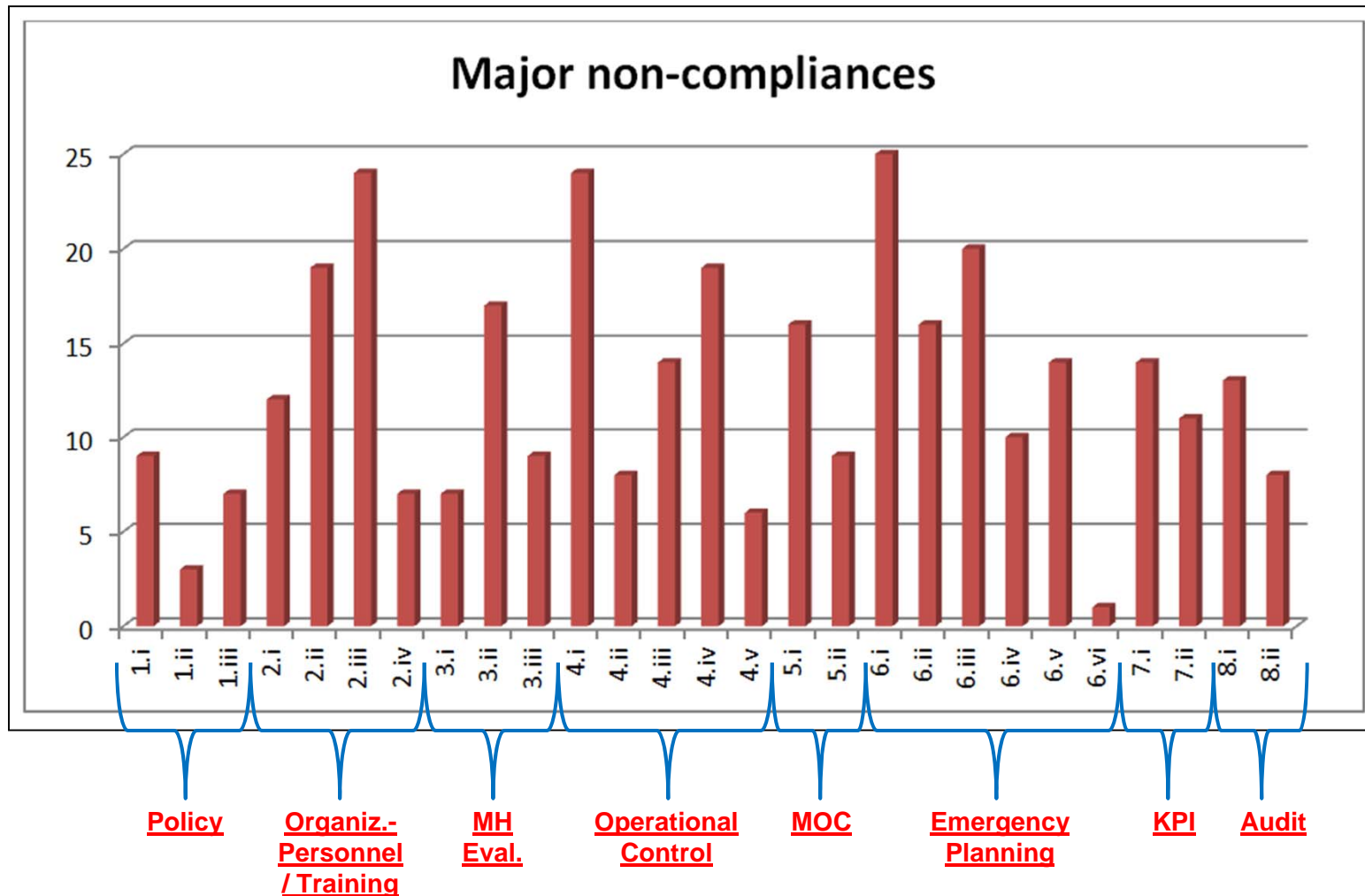
- ▶ Technical results of the **control activities** carried out by **ISPRA** and **SNPA**, as reported in the SMS inspections **data-base**
 - ▶ Taken into account **a sample of 5 Seveso establishments**, of the **LPG and LNG** sector, belonging to the **mentioned types**
- ▶ Information and data about the **findings** that emerged during the last **SMS inspections**
 - ▶ The inspection commission must verify the **suitability of the operator MAPP** (Major Accident Prevention Policy) carrying out a planned and systematic **examination of the systems** being employed at the establishment, whether of a **technical, organizational or managerial** nature

SMS inspections: the national situation of LPG and LNG sector (70 inspections in the time frame 2009 - 2015) – 1/2



- ▶ *Minor non-compliance: an evidence of formal aspects not adequately fulfilled (for example, the requirement for a standard adopted voluntarily not completely satisfied, due to lack of adequate supporting documentation, an element of the SMS adopted by the operator but without adequate documentation to support it, etc.).*

SMS inspections: the national situation of LPG and LNG sector (70 inspections in the time frame 2009 - 2015) – 2/2



- ▶ *Major non-compliance: an evidence of substantial not-compliance with legal requirements, technical standards taken as reference for the SMS or corporate standards. A minor non-compliance not corrected (for example, identified during the last inspection and not taken into consideration by the operator), may also become a major non-compliance during the subsequent inspection.*

LPG storage and city distribution

- ▶ Training activities compliances
 - ▶ Systematic **distribution** to workers of **updated documentation**
 - ▶ **Consultation** of the worker's **representative**
 - ▶ **Compliance** with the established **periodicity of programs**
 - ▶ **Verification of learning** for workers and contractors
- ▶ Operational control compliances
 - ▶ Identification of **critical technical systems** and consequent **planning of maintenance** programs
 - ▶ Update **maintenance procedures**
 - ▶ Update the **operating manual with fault conditions**
 - ▶ Deepening and implementing the **work permit procedure**
- ▶ Emergency planning compliances
 - ▶ Review of the **IEP and consultation** of the workers
 - ▶ Definition of **roles of all units involved** in the emergency
 - ▶ Definition of all **PPE provided for workers**
 - ▶ Technical support **documentation in all departments**

LPG underground storage

- ▶ Training activities compliances
 - ▶ Highlight aspects related to the “Seveso and MAP” issues in training activities
 - ▶ Training activities also following regulatory developments and improvement of technical and managerial knowledge
- ▶ Operational control compliances
 - ▶ Updating the “document management” procedure with references to the technical documentation at all departments
- ▶ Emergency planning compliances
 - ▶ Procedure for site management following an accident
 - ▶ Supporting external investigations including accident reporting and the safeguarding of objective evidence

Multi-site LPG storage company

- ▶ Training activities compliances
 - ▶ Systematic **distribution** to workers of **updated documentation**
 - ▶ **Compliance** with the established **periodicity of programs**
 - ▶ **Verification of learning** for contractors
 - ▶ Criteria for **qualification of trainers**
- ▶ Operational control compliances
 - ▶ Ensure digital **recording of maintenance interventions**
 - ▶ Update the **operating manual with references to technologies actually present**
 - ▶ Indicate in the **work permit procedure the roles and responsibilities** of all personnel involved
- ▶ Emergency planning compliances
 - ▶ Review of the **IEP (intervention procedures; emergency team)**
 - ▶ Procedures in **night hours (time of intervention; communication)**
 - ▶ Availability of **PPE and devices provided for workers**
 - ▶ Correct definition of **establishments exit routes**

Offshore LNG storage and re-gasification terminal

- ▶ Training activities compliances
 - ▶ Systematic **distribution** to workers of **updated documentation**
 - ▶ **Program** training by specifying **periodicity and issues**
 - ▶ **Consultation** of the worker's **representative**
 - ▶ **Verification of learning** for contractors
- ▶ Operational control compliances
 - ▶ Identification of **critical technical systems** as a result of SR and consequent **planning of maintenance** programs
 - ▶ Ensure digital **recording of maintenance interventions**
 - ▶ Update the **operating manual with fault conditions**
 - ▶ Complete the **modules** provided by the **work permit procedure**
- ▶ Emergency planning compliances
 - ▶ Review of the **IEP and consultation** of the workers
 - ▶ Criteria about the **number of personnel in the emergency team**
 - ▶ Site **emergency simulation planning**
 - ▶ Positioning of **lifeboats** provided for workers

Conclusions and guidelines

Safety reports assessments: legal provisions for simplifying activities carried out by Competent Authorities – 1/2

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- ▶ **4 fundamental legislative instruments** that are relevant to the issue of **LPG safety reports assessments**
- 1) *D. Lgs. 105/2015 – Allegato C “Criteri, dati e informazioni per la redazione e la valutazione del Rapporto di sicurezza e del Rapporto preliminare di sicurezza”*
 - **Criteria for Seveso SR editing**: establishments information, plants safety, emergency and intervention means
- 2) *DM 9 maggio 2001 “Requisiti minimi di sicurezza in materia di pianificazione urbanistica e territoriale per le zone interessate da stabilimenti a rischio di incidente rilevante”*
 - **LUP issues for all kinds of establishments**: plant categorization, threshold values for different impacts, etc.

Safety reports assessments: legal provisions for simplifying activities carried out by Competent Authorities – 2/2

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▶ ...

- 3) DM 15 maggio 1996 “Criteri di analisi e valutazione dei rapporti di sicurezza relativi ai depositi di gas di petrolio liquefatto (G.P.L.)”
 - **Analysis and evaluation criteria of the safety reports for LPG:** storage categorization, scenarios evaluation, threshold values, plant adjustments to control the risks
- 4) DM 13 ottobre 1994 “Approvazione della regola tecnica di prevenzione incendi per la progettazione, la costruzione, l'installazione e l'esercizio dei depositi di G.P.L. in serbatoi fissi di capacità complessiva superiore a 5 m³ e/o in recipienti mobili di capacità complessiva superiore a 5.000 kg”
 - **Fire safety criteria** for design, construction, installation and operation of new LPG storage (over 5 m³)

Safety reports assessments: common aspects of the activities carried out by Competent Authorities

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- ▶ **Scenarios and damage zones** after technical final evaluations
 - ▶ **Explosions** (UVCE): order of 500 m
 - ▶ **Flash fires**: order of 100 – 400 m
 - ▶ **Jet fires**: order of 100 – 200 m
 - ▶ **Pool fires**: order of 100 m
- ▶ **Requirements, conclusions and compliances**
 - ▶ **Plant/structures**: pumps and safety valves; safety equipment at transfer points; control of the storage tanks
 - ▶ **Organization/management**: emergency procedure at transfer points and tanks; communication systems
 - ▶ **Documents**: seismic analysis; domino effects; vulnerable elements and impact outside; risk scenarios with NG network

SMS inspections: legal provisions for simplifying activities carried out by ISPRA and SNPA

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- ▶ **2 fundamental legislative instruments** (in addition to the previous) that are relevant to the issue of **LPG SMS inspections**
- 1) *D. Lgs. 105/2015 – Allegato H “Criteri per la pianificazione, la programmazione e lo svolgimento delle ispezioni”*
 - **Criteria and procedures for conducting inspections:** specific check-list for SMS-MAPP inspections in establishments with high standardization (LPG storage)
 - **Simplification of some items:** business organization, doc. check, equipment control, emergency planning
- 2) *DM 15 maggio 1996 “Procedure e norme tecniche di sicurezza nello svolgimento delle attività di travaso di autobotti e ferrocisterne”*
 - **Transfer procedure for LPG tanker and railway tanker:** vehicle positioning, fire fighting systems, op. manual

SMS inspections: common aspects of the activities carried out by ISPRA and SNPA

- ▶ **Compliances** after examination of the **management systems employed**, whether of a technical or organizational nature
 - ▶ **Training activities**: updated documentation; periodicity of programs; workers consultation; learning verification
 - ▶ **Operational control**: critical technical systems identification; recording of maintenance interventions; updated operational manual; work permit procedure completeness
 - ▶ **Emergency planning**: review of IEP and consultation; emergency team and simulation; PPE and devices for workers; management and investigations after accidents

Thanks for the attention!

Any question...?

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