Controling 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)
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

- **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

- **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

- **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

- **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
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

<table>
<thead>
<tr>
<th>Establishments</th>
<th>UVCE (bar)</th>
<th>Flash Fire (-)</th>
<th>Jet Fire (kW/m²)</th>
<th>Pool Fire (kW/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I (0.3)</td>
<td>II (0.07)</td>
<td>III (0.03)</td>
<td>I (12.5)</td>
</tr>
<tr>
<td>LPG storage and city distribution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LPG underground storage</td>
<td>360</td>
<td>370</td>
<td>450</td>
<td>150</td>
</tr>
<tr>
<td>Multi-site LPG storage company</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Offshore LNG storage and re-gasification terminal</td>
<td>290</td>
<td>420</td>
<td>60</td>
<td>20</td>
</tr>
</tbody>
</table>

*Values in brackets represent specific conditions or factors.*
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
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.).
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
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.
   • 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

- 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
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
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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