



**POLITECNICO
DI TORINO**

In collaboration with



**DGS
UNMIG**

Ministry of Economic Development

DIRECTORATE GENERAL FOR SAFETY OF MINING AND ENERGY ACTIVITIES
National Mining Office for Hydrocarbons and Georesources

Guidelines for the preparation of Reports on Major Hazards

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Outline

- The framework and the SEADOG DENERG team
- The Guidelines:
 - The purpose
 - Preliminary assessment
 - Structure
 - Key features
- Cooperative activity



The framework and the SEADOG DENERG team

- Along with the partnerships with relevant research centres, universities and other public bodies, the DGS-UNMIG of the Italian Ministry for Economic Development (MiSE) signed an agreement with Politecnico di Torino for supporting research and co-operation on the topic of offshore safety.
- At Politecnico, the SEADOG (*Safety & Environmental Analysis Division for Oil & Gas*) Laboratory was set up to carry out the activities foreseen by the agreement.
- Three Departments cooperate in the SEADOG Lab: Energy Dept., Environment, Land and Infrastructure Engineering Dept. and Applied Science and Technology Dept.
- The SEADOG DENERG (Energy) branch was given the responsibility to prepare Guidelines for the writing of Repots on Major Hazards as requested by the EU Directive and by the Italian Decree D.Lgs. 145/2015.
- The SEADOG DENERG team is composed of Postdoc Research Fellows, PhD Candidates, MSc candidates, Senior experts, and operates under the responsibility of Prof. Andrea Carpignano.

The purpose of the Guidelines

- The Guidelines are a document meant to provide a practical support for the **preparation** of all the reports required by Italian legislation (D.Lgs. 145/2015), i.e. **reports on major hazards** for production and non-production installations, **notification** to Authorities regarding all the stages in the plant life cycle (well operations, new projects, plant transfer, simultaneous operations, decommissioning).
- The Guidelines should be helpful for:
 - The Authority: they provide a support during the assessment of reports presented by the Operators.
 - The Companies: they support during the reports preparation so that they meet the standard content criteria expected by Authorities;
 - The Certification bodies: they indicate which information the Operator was requested to provide and they propose standard verification schemes taken from international best practices.

The Guidelines

Preliminary assessment and deliverables

- Assessment of the D.Lgs. 145/2015 and check of the existence of potential application criticalities
- Thorough literature analysis: links and examples from similar regulatory bodies in other European countries to compare prescriptions, criteria and approaches
- Definition of the document **structure**
- **Delivery** of the first draft of the Guidelines for the preparation of the Report of Major Hazards for production installations, Notification of combined operations and Annex on risk tolerability criteria. → **July 2016**
- **Delivery** of the full first issue of the Guidelines → **17th of March 2017**
- The Guidelines will be available soon at the Competent Authority (Comitato) so as to become an operating tool for Operators and Authorities.

Summary of the Guidelines

CHAP. 1: Introduction

CHAP. 2: Technical principles

CHAP. 3: Report on Major Hazards for production installations

CHAP. 4: Notification of combined operations

CHAP. 5: Report on Major Hazards for non-production installations

CHAP. 6: Report on Major Hazards in case of material changes

CHAP. 7: Notification of well operations

CHAP. 8: Notification of a new project

CHAP. 9: Notification of removal of a fixed installation

ANNEXES

Annex 1 – Hazardous area classification

Annex 2 – Safety criteria

Annex 3 – Tolerability criteria for the people and the environment (risk target)

Annex 4 – Risk analysis

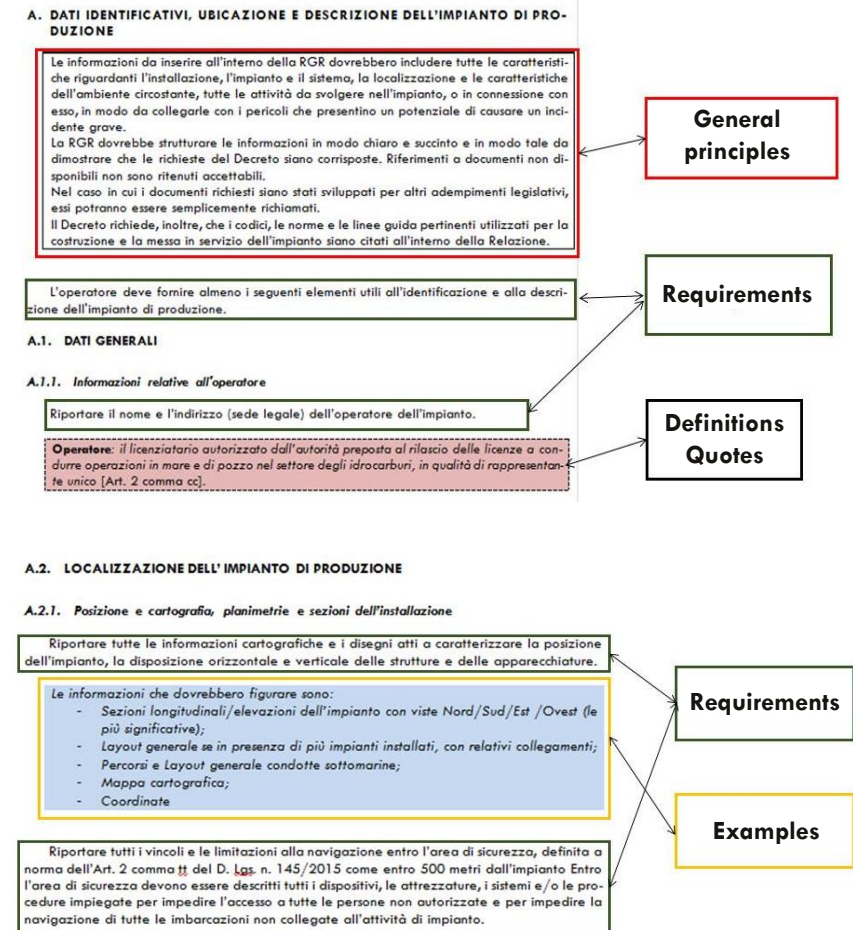
Annex 5 – Safety critical elements and performance standards

Annex 6 – SIMOPS Methodology

Annex 7 – Basic concepts for the decommissioning of a production installation

Guidelines document structure

- Each main chapter of the Guidelines was developed according to this scheme:
 - **Part A** – containing identification data, the siting and **description** of the installation
 - **Part B** – containing details about the **management** of the plant
 - **Part C** – containing the **risk analysis** of the installation (or of the operation)
 - **Part D** – containing the details about the operating safety and **emergency management systems**



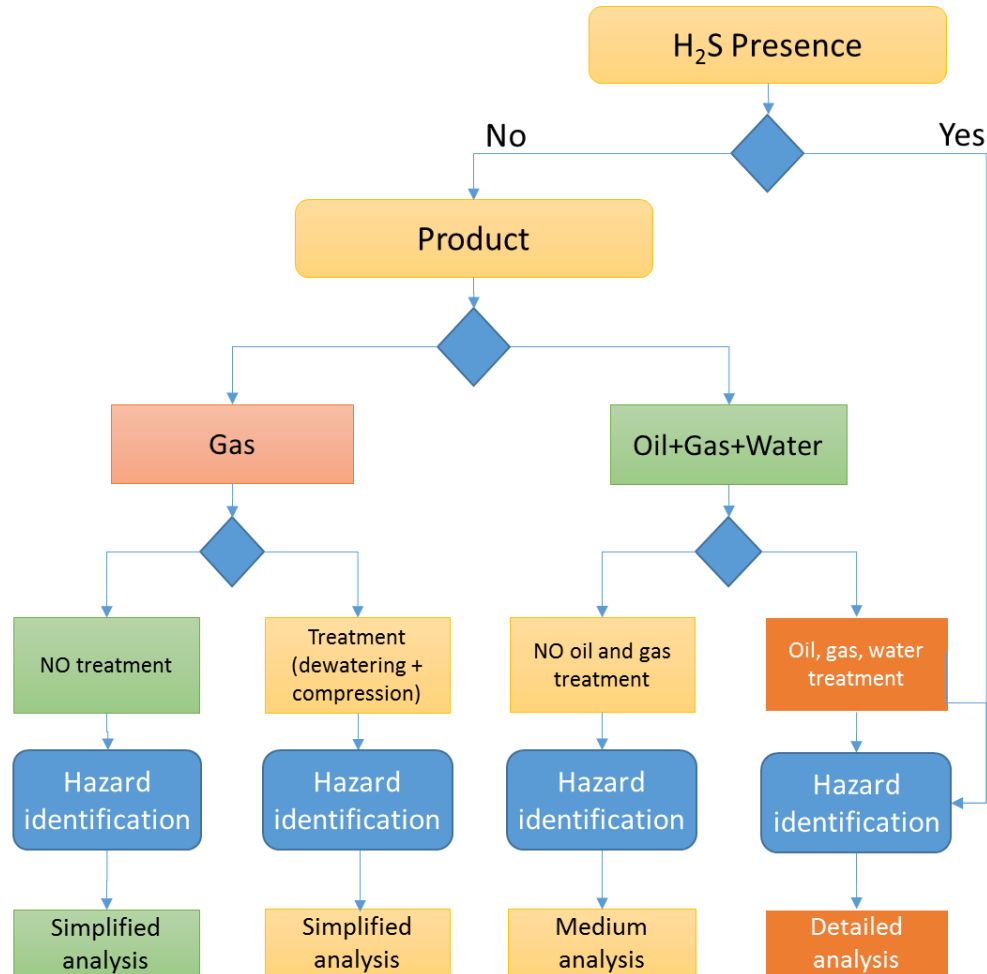
Key features

Selection of analysis methodology

Ref.	Product	Process characteristics	Typology of suggested analysis
H1	Presence of H ₂ S (>100 ppm)		Detailed
G1	Dry Gas, Wet Gas, with Condensates	Without gas treatment	Simplified
G2	Dry Gas, Wet Gas, with Condensates	With gas treatment	Medium
G3	Gas + Oil + Water	Without gas treatment Without oil treatment	Medium
G4	Gas + Oil + Water	With gas treatment With oil treatment With water treatment	Detailed ^[1]

^[1] For existing installations which may have a relevant complexity, a medium type analysis may be adequate

Key features Hazards identification



Hazards identification can be done by means of: HAZID, HAZOP, what if, FMEA, FMECA, check list

In case of new installations:

- the HAZID technique is recommended to investigate **external events** while
- the HAZOP technique is recommended to study the hazards connected to the **processes deviations**.

Whichever the technique, all hazards and the events which may be caused by them (initiating events) must be identified, considering:

- Technical failures
- Human errors
- SW errors
- External events

Key features

Selection of analysis methodology

Simplified analyses

- The methodologies suggested include HAZOP, HAZID or FMECA for hazard identification and the evaluation of the risk level by means of Bow-Tie or LOPA methodologies for the scenarios deemed critical after the hazards identification.
- In case of simplified analysis, it is requested to perform:
 - a **qualitative** (by means of indexes) or **semi-quantitative** (by means of ranges of order of magnitude) estimation of the frequencies and
 - a **qualitative** estimation of the damages.

Key features

Selection of analysis methodology

Medium analyses

- The suggested methods include the application of **Bow-Tie or LOPA for all the scenarios deemed critical** after the hazards identification.
- In the case of medium analysis, it is requested to perform:
 - A **qualitative** evaluation of the damage and
 - A **quantitative** evaluation of the frequency of accidental scenarios.
- **Scenario frequency** → quantitative estimation of both the frequency of initiating events and of the unavailability/unreliability of the protection/mitigation barriers focusing, in particular, on the dependencies among failures (common cause failure analysis – **CCF**).

Key features

Selection of analysis methodology

Detailed analyses

In order to guarantee the completeness of the quantitative analysis of risk, the following studies may be executed, where applicable:

- QRA (Quantitative Risk Assessment)
- FERA (Fire and Explosion Risk Assessment)
- EERA (Evacuation, Escape and Rescue Analysis)
- Dropped objects
- Helicopter crash
- Vessel collision
- Human factor

Key features

Risk tolerability criteria

Risk tolerability for **humans**:

- Possible acceptability criteria to be used can be derived from HSE UK experience and they express the individual average risk level (per annum) for an offshore installation:
 - Maximum tolerable risk for an installation in general: 10^{-3} per person/year
 - Reference value for installations (new or modern): 10^{-4} per person/year
 - Acceptable risk in general: 10^{-6} per person/year

Environmental risk tolerability:

- A possible criterion that takes into account:
 - The sensitivity level of the receptor
 - The severity of the damage caused by the accidental event.

Key features

Material changes identification

According to the Decree, a material change in an installation is the one which entails:

- The **change** of a safety and environmental critical element (SECE);
- The **change** of a protecting or mitigating barrier;
- The **change** of the operating conditions of the installation, with respect to what foreseen during the design phase (e.g. with reference to flow rates, pressures, temperatures, volumes, etc.)
- The introduction of **new hazards** which can lead to major accidents (e.g. the introduction of the dangerous substances)
- Any change which implies the **revision of the list of SECE**.

Cooperative activity

We were not alone...

- A Working Group on the topic of Offshore safety was set in the framework of the VGR Conference (Valutazione e Gestione del Rischio – Evaluation and Management of Risks).
- The Group is coordinated by Prof. Andrea Carpignano (SEADOG DENERG) and includes the most important stakeholders (MiSE, MATTM, ISPRA, Eni, Edison, Rina, DNV-GL, TUEV, CNR, JRC, D'Appolonia, Marina, Capitanerie, OGS...)
- 4 meetings have been organised which have helped to share opinions, methods and visions.

Cooperative activity

- Additional support was provided to the SEADOG team by Authorities and Companies, as 6 people of the Working Group were enabled to pay a visit to two major installations offshore Ravenna and Ancona.
- Useful participation to the Workshop on “Assessment of Reports on Major Hazards” organised by JRC @ Ispra in October 2016.



Thank you for your attention

SEADOG DENERG

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