
TEChnologies for Safety and the Environment

CONSULTING COMPANY SPECIALIZED SINCE 1979


## TEChnologies for Safety and the Environment

**“Priusquam incipias consulto, ubi consulueris, mature facto opus est”**

**- SALLUSTIO -**

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# About us

**Tecsa S.r.l. is a consulting company, founded in 1979 by Carlo Fiorentini, which operates both nationally and internationally in the field of safety, environment, fire protection, safety management systems and forensic engineering.**

Tecsa S.r.l. mainly operates from its offices (HQs) located in Pero (Milan) – Italy.

Over the years the structure and the members of senior management have become a point of reference in the panorama of industrial safety (particularly in the area of process especially those subject to the EU Seveso Directive) and fire engineering including Performance Based Fire Engineering.

History of the company underlines a continuity of operation which over time has resulted in the assuming of a leading role in the Italian panorama of fire engineering and industrial risk assessment and loss prevention.

Tecsa technicians are authors of books and numerous articles in scientific journals for which they also operate as reviewers or members of the editorial board. They participate in many professional associations operating internationally, as well as in Italian, european and international technical standardisation and regulation committees; they provide technical consultancy and expert witness for public prosecutors and judges regarding incidents of national significance on the occurrence of fires and explosions; they carry out teaching activities both at university level and in safety and fire prevention courses organised by professional associations.

Tecsa S.r.l. makes use of a number of national and international collaborations with universities, research institutes and individual professionals and engineering and consultancy companies with proven experience of specialized activities in support of the core corporate business of reference.

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# Quality Management System

Tecsa engineering and consultancy activities have always been performed with methodological and scientific rigour in compliance with legal requirements and in respect of the deadlines defined by customers and authorities having jurisdiction. The entire process of development of the specialist consultancy activities has been certified since 30th July 2004 according to the standard UNI EN ISO 9001 (now 9001:2008). The current scope of the QMS that complies with the 9001 requirements is:

***"The development and provision of consultancy and training services relating to accident risk, environmental analysis, safety analysis, fire engineering and forensic engineering".***

The activities are supported by constantly updated methods and tools including calculation codes and advanced simulation tools (including FEM and CFD). Special attention is given to research and development activities supported by a "Systems" and an "R&D" division dedicated to the development and validation of numerical codes and, "in-house" integrated software packages.

The research activities are very often conducted with European partners who are also contributors to the academic community.

Over the years the significant company growth in specific sectors led, mid-2015 in particular, to the definition of two specialist divisions governed by internationally recognised experts and related, respectively, to the areas of **"Operational Excellence"** applied to the process industry and **"Forensic engineering" (MFCForensic)**. Similarly, over the years, the target market starting from the refining and petrochemicals world, was extended to the military sector, the transport sector and to critical infrastructures (including ports, airports, railway terminals and stations).

In support of the operational activities in the areas of interest and of the teaching activities at university level, the senior management of the company participates in numerous technical and scientific associations of national and international (NFPA, SFPE, IASFSS, The Chartered Society of Forensic Sciences).

# CERTIFICATIONS

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# OIL&GAS

The “Oil and Gas” world is, historically, the target market for the activities of TECSA S.r.l. and the sphere from which many senior consultants of the company come as well as external experts for highly specialist services.
TECSA S.r.l. has an extremely important customer base in Italy consisting of the major oil companies that operate both in the market share called **“Exploration & Production”** and in that called **“Refining and Marketing”** respectively with onshore/offshore sites and refining, storage, distribution and sale installations. The same activities have been carried out successfully for several years abroad (both in Europe and in emerging markets), supporting both the revamping of existing sites and offshore installations and assisting with the creation of new production sites. The latter activity is carried out through the development of urban planning studies, feasibility studies, verification of preliminary layouts, PHA, etc.

In that context, TECSA S.r.l. is recognised as being a skilled, fast and reliable partner for the performance of studies of HSE, major hazards (Seveso Directive), internal and external emergency planning and fire prevention in addition to, where appropriate, being a reference point for specialist issues relating to studies of reliability and availability, environmental impact, the investigation of incidents, accidents and near-accidents, forensic engineering and functional safety, including.

- HAZID/HAZOP
- Dropped Objects Analysis
- FERA
- QRA (2D, 3D)
- Fire & Gas Mapping (2d, 3D)
- SIMOPS
- ATEX
- Explosion risk area classification

Experience and references gained over three decades of constant support have resulted in the expansion of activities to all the process industries (with particular reference to the companies subject to the provisions laid down in the Seveso Directives I, II and III), to the energy industry, to the mining sector, to the pharmaceutical one and, more recently, to the “automotive” and food sectors, always at the service of national, European and international companies.

# CUSTOMERS

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# INFRASTRUCTURES

TECSA S.r.l. is an ideal partner for consultancy requirements relating to safety, security, the handling of dangerous goods, the prevention of fire and major hazards, within the framework of strategic infrastructures (ports, airports and railway stations).

For such operational organisations, wholly peculiar, TECSA S.r.l. is able to offer, alongside the traditional specialist consultancy services, a comprehensive set of services including:

- "due diligence" and "audit" for the HSE aspects;
- the implementation of corporate systems of risk management (ISO 31000) and of business continuity management;
- consultancy to senior management for the implementation of HSE performance monitoring systems (KPIs) through the provision of ad hoc information tools;
- the development of activities relating to fire prevention administrative proceedings (including exceptional);
- fire risk assessment for the purposes of identification of priorities for securing interventions and operations, guaranteeing performance (e.g. with specific methods of analysis such as "Bow-Tie");
- complexity assessment (VACO) according to the recent standard UNI 11613. The standard provides each organisation with guidelines to plan, develop, implement, monitor and review the process of Complexity Assessment (VACO) of own systems in order to identify and classify problems and to improve the resilience of the organisation itself;
- security risk assessment.

The company is also very active in the field of energy infrastructures, specifically those related to renewable energies. **Over the past five years both quantitative risk analysis and analysis of energy availability and reliability were conducted of electric power generation systems and of storage systems produced by wind farms and photovoltaic systems, in Italy and abroad.** As a result of the problems of fire that characterize photovoltaic generators,

With regard to the logistics and transport sector TECSA S.r.l. combines its traditional HSE and fire-protection consultancy with specific activities such as:

- fire risk assessment and modelling of the dynamics of fire in tunnels and underpasses;
- the assessment of fire risks, of incidental dynamics and of escape in emergency ("Mass Motion") of complex organisations affected by the presence of the general public including passenger ships and ferries;
- industrial risk assessment in the presence of transportation (including on road and rail) of hazardous goods;
- collision risk assessment in ports, at sea or on waterways and determination of the consequences in terms of accident scenarios expected, also in order to improve naval traffic regulations;
- the assessment of risk associated with the presence of networks of material transportation and underground energy.

# OTHER INDUSTRIES

The skills, experience and methodologies consolidated over time in addition to the tools (i.e. calculation codes) and resources enable TECSA S.r.l. to offer a **modern and efficient HSE consulting service in a multitude of cases** and not limited to the services originally offered by the company and which have resulted in it achieving a prominent role both nationally and internationally.

Thanks to the diciplines that can be provided TECSA S.r.l., both through its direct employees and through its high specialisation consultants, HSE advice can be effectively applied to different areas of intervention including:

- Oil&Gas onshore and offshore plants, refineries, hydrocarbon storage facilities, compressor stations, distribution reception points;
- marine terminals and naval transportation (passenger vessels, container carriers, Ro-Ro, Ro-Pax, etc.);
- petrochemical and chemical plants;
- pharmaceutical companies;
- fine chemical companies;
- manufacturing facilities;
- cement plants;
- intensive warehouses (also with a high level of automation);
- waste collection, treatment and disposal facilities (including for special waste);
- critical infrastructures where high resilience is required (ports, airports, railway stations, hubs and logistics sites, energy and technological networks, various types of infrastructures);
- food companies;
- energy production industries and energy generation sites starting from renewable sources;
- naval transport vehicles (passenger vessels, container carriers, Ro-Ro, Ro-Pax, etc.);
- electroplating and metal treatment systems.

# LEGAL AND INSURANCE ASSISTANCE AND TECHNICAL EXPERTISE

For many years TECSA S.r.l. has put its expertise at the service of forensic engineering activities performed directly rather than through third parties, both in court and in the insurance sector.

In judicial matters the TECSA S.r.l. technicians assume both the role of technical consultants representing one party and the role of Expert Witness, both on behalf of prosecutors or on behalf of the court in cases of high-complexity or where, in order to manage the proceedings as a forensic engineer, it is necessary to implement methods of further detailing and developing specialist expertise.

Starting from 2015 TECSA S.r.l., **due to the great efforts in the area of forensic engineering, has developed its own specific division that is competent on the subject and which is called MFCforensic that offers its services both in Italy and abroad** through the recognised skills of each expert who is part of it and in particular by Luca Fiorentini, Luca Marmo and Bernardino Chiaia who coordinate the division's activities according to the specific skills.

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# INDUSTRIAL RISK ANALYSIS

- Risk identification, using hazardous substance compatibility matrices, **Check Lists**, Preliminar Hazard Analysis **(PHA)**, Hazard and Operability Studies **(Hazop)**, Historic Analysis, Index Methods, “What if” Analysis, Failure Modes, Effects and Critically Analysis **(FMECA)**, Incident Reviews, analysis of independent protection levels **(LOPA)**, **HAZID** initial analysis.
- **Frequency estimation** of releases and/or of incidental scenarios, using databases and methodologies such as Fault Tree Analysis **(FTA)** and Event Tree Analysis **(ETA)**.
- Estimate of consequences, through the mathematical modelling of releases of hazardous substances and the possible resulting incidental scenarios such as the dispersion of toxic and/or flammable products, fires from wells or jets, confined and non-confined explosion (VCE/UVCE), BLEVE.
- **Estimate of consequences** of incidental events with traditional computational codes (including 3D approaches) and **CFD**.
- Preparation of Facilities Safety Reports and Safety Reports for the phases of Feasibility Clearance (NOF) and of Detailed Project (PP), in accordance with the current regulations for the prevention of major accidents (Legislative Decree n. 105/2015 and EU Seveso Directive).
- The processing of Documentation of Non-Increase of the Existing Level of Major Accident Risks (NNA), in accordance with the current regulations for the prevention of major accidents.
- Risk analysis for verification of the essential safety requirements of the set, in accordance with the Pressure Equipment Directive **(PED)**.
- Technical assistance during the investigative phases with the authorities having jurisdiction; Sworn appraisals.
- The processing of **Safety Management Systems Procedures and Manuals for the Prevention of Major Accidents**, support in implementation, audit and assistance during inspections. SIL Assessment (SIL Allocation, SIL Verification) in compliance with EN 61511 standard.
- Land use planning.
- Root cause analysis of incidental events **(Root Cause Analysis, Tripod Beta, Bow-Tie)** including post-incidental investigation.
- **Security risk assessment.**

# OCCUPATIONAL SAFETY AND HEALTH

- Occupational Health and Safety.
- Quantitative **Fire risk assessment**.
- Verification of micro-climatic and lighting conditions in the workplace using instrumental measurements for the purpose of verifying compliance with statutory parameters/technical rules and standards of reference.
- Simulation, using specific codes (e.g. DIALux), of lighting adjustments suggested for the purposes of compliance with the reference and design standards of workplaces.
- Safety analysis for the assessment of explosion risks and for the determination of the essential safety requirements of equipment and sets.
- **Classification of areas at risk of explosion** due to the presence of gases, vapours, mists and dusts in accordance with EC regulations.
- Safety analysis for assessing the risks of explosion or fire for the health and safety of workers who may be exposed.
- Verification checklists and compliance with standards and regulations.
- **Internal Emergency Plans (EIP)** in relation to the identified scenarios.
- Checking of consistency of the emergency team in relation to the incidental scenarios identified and to the emergency measures to be implemented.
- Support in verifying the effectiveness of the application of internal emergency planning through supervised **emergency simulation**.
- Preparation of **Operating, Maintenance and Safety Manuals**.
- Verification and compliance with the “PED” Directive (Legislative Decree 93/2000 et seq.).
- Fire Log formulation and equipment maintenance documentation.
- Machine safety verification according to the “Machinery Directive”.
- Safety services within the context of temporary and mobile construction sites.

# SERVICES

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## SYSTEMS ENGINEERING AND SOFTWARE DEVELOPMENT

- **Software tools for the analysis of safety and reliability** developed specifically for certain issues or investigations.
- The customisation of existing computational codes.
- The **development of computerised emergency plans** for individual companies or for the territory through hypertext, multimedia, virtual and augmented reality and internet/Intranet technologies.
- The development of **web-based documentation** (e.g. operating manuals).
  The development of **information systems for the management of work permits**.
- The development of multimedia operating, production multimedia and safety manuals.
- The development of computerised handouts and **learning management systems**.
- The development of simulations of decision support dynamics and of complex decision models.
- The development of **simulated processes, production activities and systems**.
- The development of advanced software tools for **managing and monitoring workplace health and safety** through specific kPIs.
- The development of software and information systems tools to support health and safety management systems and workflows.
- **Corporate knowledge management systems**.
- Audit of the procedural body and analysis of algorithms to support the human reliability assessment **(HRA)**.

## ENVIRONMENTAL ENGINEERING

- **Air and water** quality.
- Assessments, including forecasts, relating to **acoustics**.
- Assessments, including forecasts, relating to **atmospheric pollution** (also in relation to vehicular traffic).
- Analysis of the **subsoil** (stratigraphy, ground water, etc.).
- The analyses of **risks related to the dispersion of pollutants into the air** on areas of a particular topography/chorography and study of the early warning and emergency procedures to be taken on high population density areas.
- Analysis of the accidental formation and dispersion in **river or marine waters** or on the ground of chemicals (mainly hydrocarbons).
- The preparation of thematic maps relating to the flora, fauna and land use.
- Environmental impact studies of new oil and chemical plants integrated, and/or modified to existing ones.
- Environmental screening and scoping.
- Environmental **audits and preliminary environmental analysis**.
- **Environmental Management Systems according to ISO 14001** schema and Emas.
- The preparation of documentation in support of the **Application for Integrated Environmental Authorisation (AIA), Consolidated Environmental Authorisation (AUA)** and specialist assistance in joint operations with the **Authorities Having Jurisdiction**.
- **LCA studies**.

# FIRE ENGINEERING

- **Feasibility studies and investment budget** for prevention systems, monitoring and active and passive fire protections in industrial plants.
- **Basic, detailed, advanced and as-built engineering** of detection systems for smoke, gas and fire, active and passive fire protection systems for chemical and petrochemical processing plants, storage of petroleum products and hazardous and toxic substances, marine terminals, on-shore and off-shore installations, steel and engineering industries, food, pharmaceutical, manufacturing industries etc.
- Verification and optimisation of the Fire and Gas detection system through F&G mapping techniques with the help of numerical codes operating in 3D.
- Assessment of the degree of functional safety relating to Fire & Gas systems also in relation to the reference standards (CEI IEC 61508 / CEI IEC 61511).
- Definition of **contemporary and intervention plans** in fire scenarios identified by risk assessment of fire or from the risk analysis of relevant incident.
- **Verification of the level of probability of failure on demand for safety instrumented systems** concerning the fire strategy identified and identification of the reliability characteristics of fire-fighting measures and systems (in compliance with the requirements of Legislative Decree n. 105/2015).
- Processing of project documentation and of the related drawings.
  Preparation of technical specifications for request for quotation of materials and equipment.
- Technical assistance for the technical evaluation of quotes.
- Development of Corporate Safety Standards.
- Design and compliance checks with national and international regulations pertaining to fire protection measures and strategies.
- Practical tests of efficiency and responsiveness to the design of water and foam fire protection systems.
- **Hydraulic testing** of fire-fighting systems and spray-sprinkler systems (with the support of specialised and validated computational codes, e.g. Sunryse Pipenet).
- Verification of the degree of availability on demand of fire-fighting networks, systems and plants (also in connection with the provisions of “Seveso III”).
- Assistance for practical testing of evacuation from offices and operational areas with particular reference to hypothesised incidental scenarios.
- Analysis and simulation with advanced computational codes (CFD) for performance assessment in the event of a fire within the performance approach to **Fire Engineering** in accordance with national laws (Ministerial Decree 9 May 2007) and the international reference standards (SFPE, NFPA, BS).
- Conducting of specific audits to determine the risk of fire for the purpose of identifying the “design scenarios” representative of the organisation in question.
- Fire assessment through analytical sessions with application of the **“Bow-Tie”** and **“Fire safety concepts tree”** methodology pursuant to Std. NFPA 550.
- Analysis and simulation with advanced computational codes of exodus in emergency situations (also masses of people).
- Analysis, **simulation with specific computational codes** and verification of the performance of the lighting system of the process plant areas and workplaces, for the purpose of verifying the operability (also in accordance with reference standards) for normal operation/activity, and for the purpose of checking the availability of illumination that is adequate in conditions of emergency exodus.
- **Checking of consistency of the fire emergency team** in relation to reference incidental scenarios.
- Audit of fire emergency planning and global fire strategy.

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## CIVIL ENGINEERING AND ARCHITECTURE

- Basic design and detailed design.
- Works supervision.
- Structural engineering.
- Earthquake engineering.
- Geotechnical engineering.
- **Analysis and management of the construction process** supported by advanced tools and methods (BIM, LBS - **Location Based Scheduling**, 2D/3D and 4D simulation).
- Land-use planning.
- Analysis of the territory through digital cartography tools and the development of geographic information systems (GIS) also on web-based platforms.
- Lighting design and verification.
- **Energy audit/diagnosis** and development of energy performance certificates (EPAs) in accordance with the provisions referred to in Ministerial Decree 26th June 2015 (national guidelines for the energy certification of buildings).
- The performance of environmental sustainability audits of construction projects both in terms of the buildings and the infrastructures through national and international recognised protocols (LEED, BREEAM, ITACA) with professional and certified technicians.
- **Facility management**.
- Design validation and execution of feasibility studies.
- Expert reports.
- Safety within the context of temporary and mobile construction sites.

## MANAGEMENT SYSTEMS

- Safety management systems for **prevention of major accidents (Seveso)**.
- Workplace safety and health management systems **(OHSAS 18001 and ISO45001)**.
- FIRE safety management systems.
- Environmental management systems **(ISO 14001 and EMAS)**.
- Energy management systems **(ISO 50001)**.
- Business continuity management systems **(ISO 22313)**.
- Functional safety management systems for the implementation of the life cycle governed by the standard IEC 61511.
- **Maintenance management systems** (including for the purpose of inclusion of requirements from RAMS studies performed by the TECSA S.r.l. sector on reliability engineering and maintenance engineering, including support in the implementation of CMMS **(Computerised Maintenance Management Systems)** and the definition of specific KPIs. Management systems are complemented by the requirements of **EN 16646** standard. This standard also establishes the relationship between the organizational strategic plan and the maintenance system and describes the interrelationships between the maintenance process and all the other management processes of physical assets.
- It addresses the role and importance of maintenance within the system of managing physical assets throughout the life cycle of an asset.
- Physical asset integrity management systems (AIM - Asset Integrity Management), particularly for offshore and onshore gas and oil companies **(ISO 55000)**, both upstream and downstream.

# RELIABILITY ENGINEERING

- System Functional Block Diagrams (FBD).
- **FMECA analysis** (“Failure Mode Effects and Criticality Analysis) of components and **FMEDA / FMEA assessment** for systems and plants.
- System Reliability Blocks Diagram (RBD).
- Definition of **critical equipment and items** (terms, tools, parameters, etc.).
- Equipment and Components  MTTF/MTTR list.
- Equipment and Components Fault Characteristics List.
- Definition of maintenance requirements, policies, list of spare parts, etc.
- **Modelling of the degradation of a component** over time to estimate the availability, considering operating conditions, external and stress events and emergency conditions.
- **Availability modelling of an industrial system** (manufacturing, process chemical, mining) to assess the importance and sensitivity measurement of the equipment involved.
- Analysis (also with tools for business intelligence and data mining) of field data for the estimation of failure rates and enhancement of **“proven in use”**.
- Optimisation of **inspections, testing and maintenance**.
- **Analysis of criticality and ranking** within complex systems.
- **Risk analysis of business interruption** in relation to the requirements of a business continuity management system and of a corporate risk management system according to the reference standards **(ISO 22313 and ISO 31000)**.
- Computerized Maintenance Management Systems **(CMMS)**.

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