ISPRA

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The ageing challenge in Italy

Fabrizio Vazzana

ISPRA-Italian National Institute for Environmental Protection and Research

Service for Risks and Environmental Sustainability of Technologies, Chemical Substances, Production processes and Water services and for Inspections

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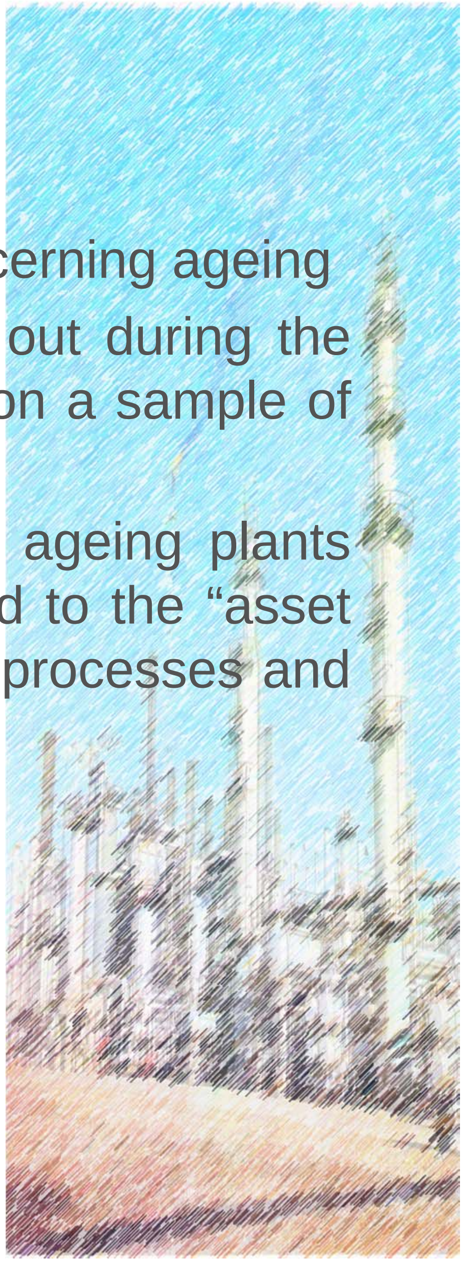
Scope of the presentation:

- overview of the Italian law and national standards concerning ageing
- examine the results of the SMS inspections carried out during the last year, to highlight the weaknesses that emerged on a sample of 40 establishments
- give some examples on how organizations manage ageing plants and installations, through specific procedures oriented to the “asset integrity management”, with a brief description of the processes and methodologies implemented.



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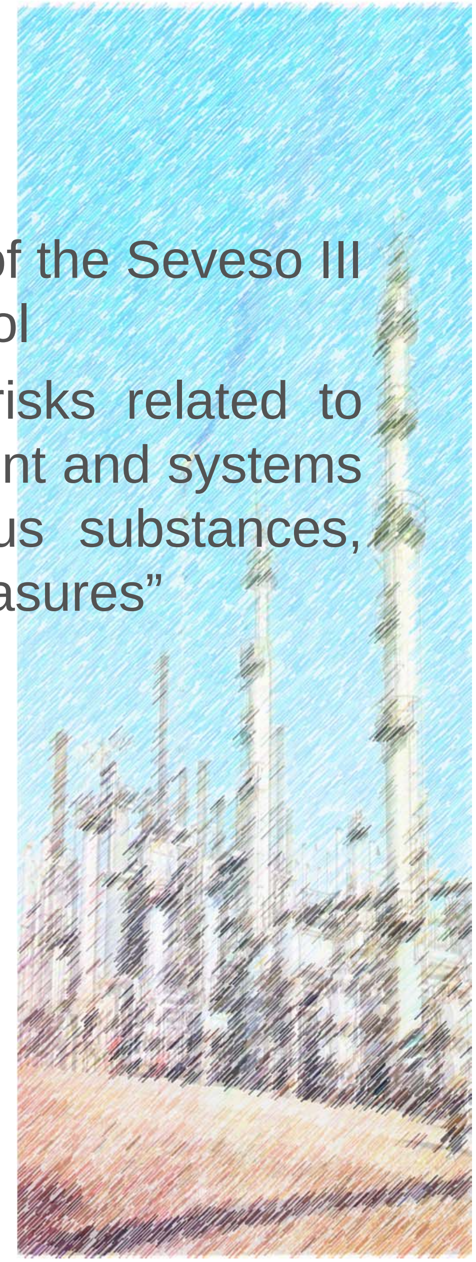
The Italian law and national technical standards:

- Legislative Decree 105/2015, on the implementation of the Seveso III Directive, and in particular Annex B-Operational control
- “To provide a plan for monitoring and control of risks related to ageing (corrosion, erosion, fatigue, creep) of equipment and systems that can lead to loss of containment of hazardous substances, including the necessary corrective and preventive measures”



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- The technical standards, present in Italy since the 90s and written to provide users specific tools for the implementation of an effective SMS:
  - UNI 10617: Major accident process plants: Safety Management System essential requirement
  - UNI 10616: Major accident process plants: Guidelines for the implementation of the UNI 10617
  - UNI 10672: Major accident process plants: Safety assurance procedures for design
  - UNI 11226: Major accident process plants: Procedures and requirements for safety audits
- Specifically mentioned in the decree transposing the Seveso Directive as “state of the art” in the field and are developed to meet both the requirements of the law, and also the structure of the other ISO standards

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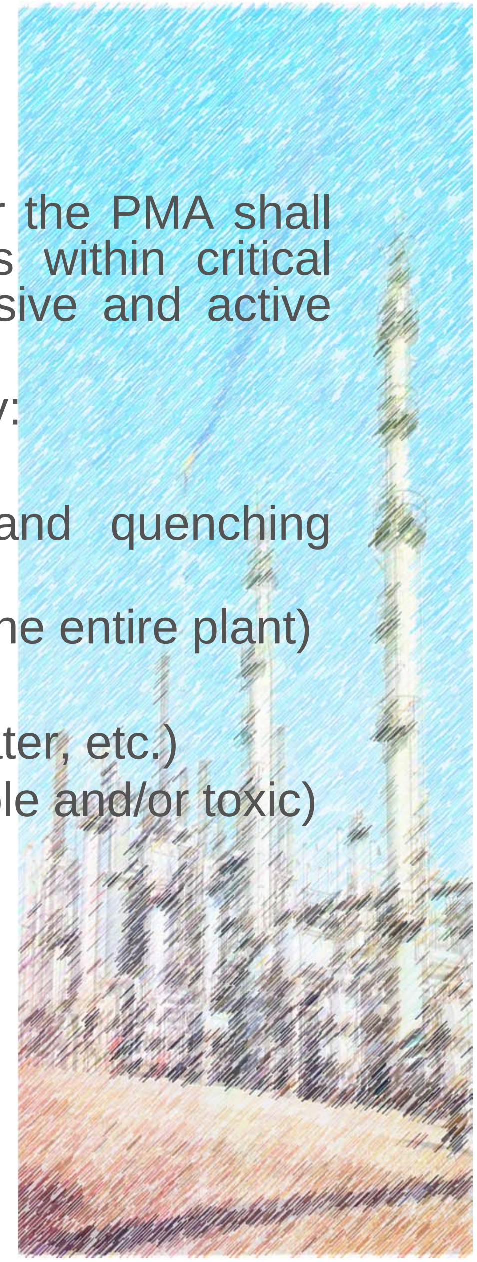
In particular:

- The integrity plan of critical systems and components for the PMA shall ensure both the containment of hazardous substances within critical equipment and / or lines and the operation of the passive and active critical safety systems
- Active and passive safety systems of interest are generally:
  - pressure relief and venting systems
  - emergency systems such as flares, scrubbers and quenching systems, etc.
  - shut-off systems (for individual equipment, units and the entire plant)
  - alarms and automatic trips
  - fire detection and protection systems (e.g., cooling water, etc.)
  - hazardous liquid and gas detection systems (flammable and/or toxic)
  - emergency services and related portable equipment

AND



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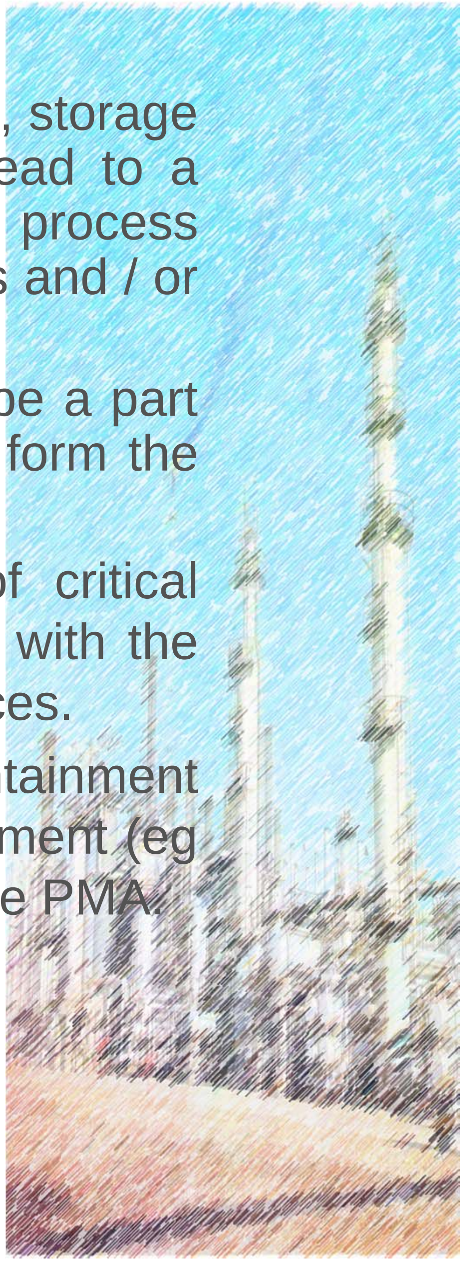
- Operational control of a plant from production, handling, storage and distribution of hazardous substances that may lead to a major accident (in case of accidental release and / or process anomalies) shall be carried out with specific procedures and / or operating instructions.
- The identification of equipment and critical lines shall be a part of the risk analysis or in the safety report and it shall form the basis of a specific inspection / control plan
- Preventive, Scheduled, or corrective maintenance of critical equipment or lines may be performed in accordance with the Risk Based Maintenance (RBM) Policies or Best Practices.
- Such maintenance shall minimize the risk of loss of containment of hazardous substances and the functionality of equipment (eg pumps, compressors and heat exchangers) critical to the PMA.



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Recognition results

Examined 40 inspection reports

In 20% of the cases, problems with the correct management of mechanical integrity were found

Can we say good? Bad? How much is the data influenced by inspectors' experience? We'll see…

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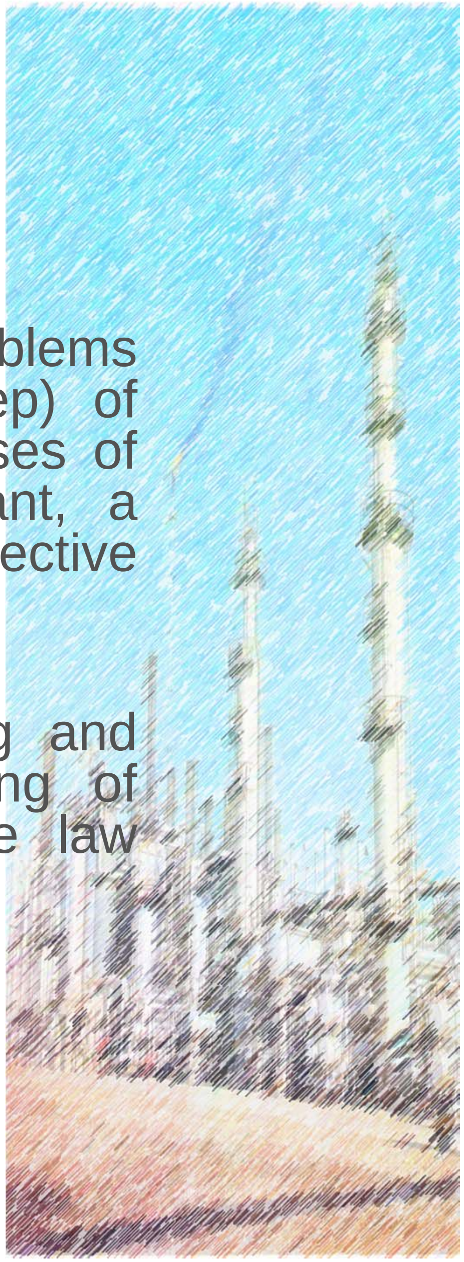
Some examples of nonconformities found

- It is necessary for the operator to analyze the problems of ageing (corrosion, erosion, fatigue and creep) of equipment and installations that can lead to losses of dangerous substances, including, where relevant, a specific monitoring plan And control, including corrective and preventive measures

- There is no evidence of a plan for monitoring and controlling the risks associated with the ageing of equipment unless it is in accordance with the law obligations



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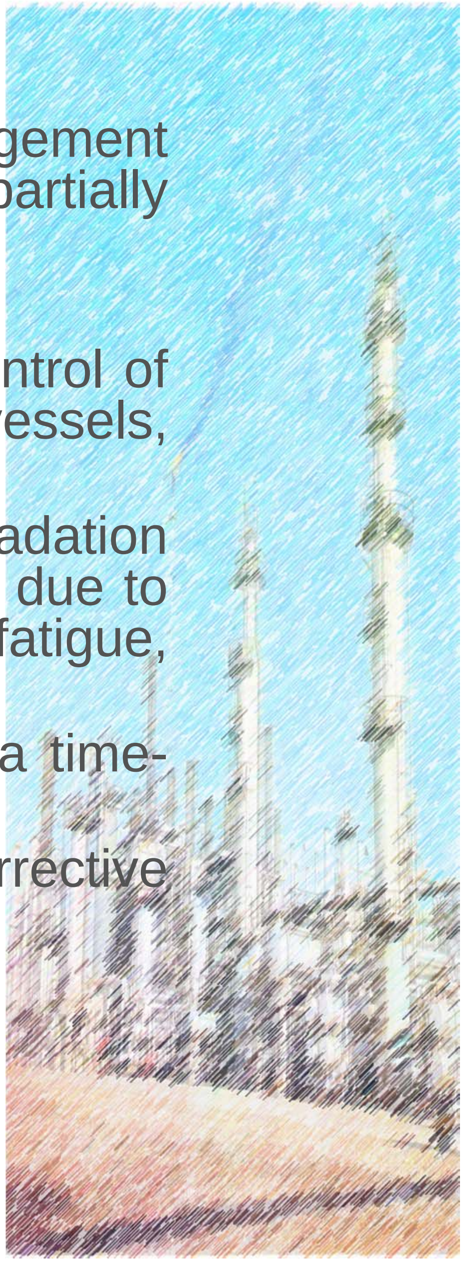

- Developed a well-structured Asset Integrity Management procedure, able to handle the issue of ageing, but partially implemented

- Lack of a specific procedure for monitoring and control of ageing. The procedure for pressure equipment (vessels, pipes, etc.) shall contain for each equipment:
  - An analysis of existing or potential degradation mechanisms, a lifetime consumed assessment due to the identified damage mechanism (eg fatigue, corrosion, etc.)
  - A fixed-term monitoring plan or, alternatively, a time-tracking plan and the techniques to use
  - A reference to preventative actions and any corrective actions

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Some examples of implementation and best practices

- **Example 1: Developing a procedure that:**
  - Defines the organizational structure of Asset Integrity Management
  - Identifies critical safety and process equipment
  - Identifies integrity critical elements (process + safety), all of which are significant items for preventing / mitigating major accidents and ensuring productivity
  - Defines the Performance Standard for Integrity Critical Elements
  - Identify KPIs
  - Prioritize and revise the Asset Integrity plans
  - Draws up and update technical documentation

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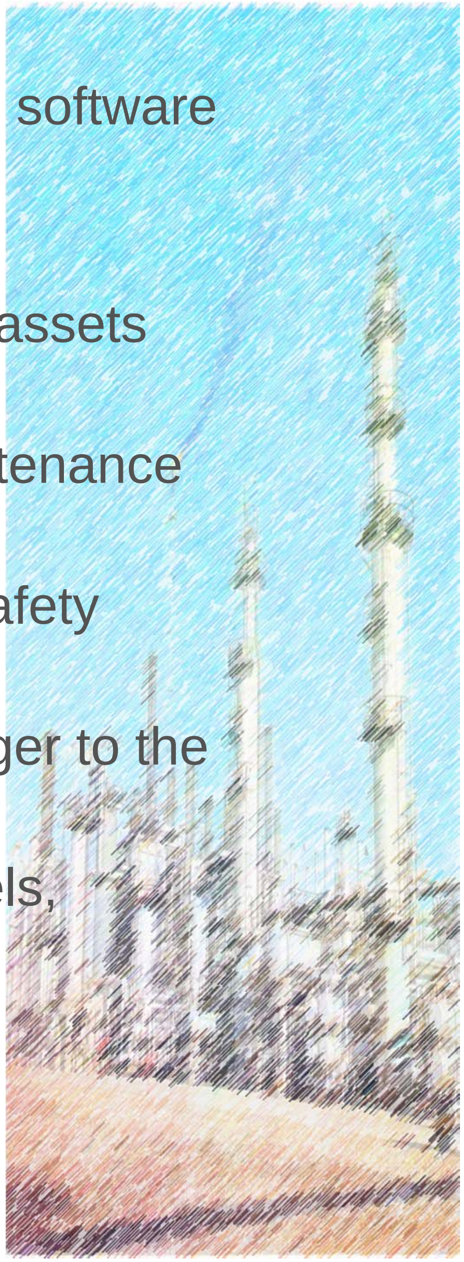
- Draws up a Registry of assets, based on systems and software for tests, documents, etc.
- Identify Critical Integrity Elements (ICE);
- Highlights the inspection / maintenance criteria for all assets (safety + process)
- Keeps Asset Integrity policies for inspection and maintenance up to date
- Implements prevention and mitigation measures for safety critical elements
- Defines roles and responsibilities (from the site manager to the development team)
- Draws up an Inventory of Identified Equipment (Vessels, Rotating Machines, Instruments, etc.)



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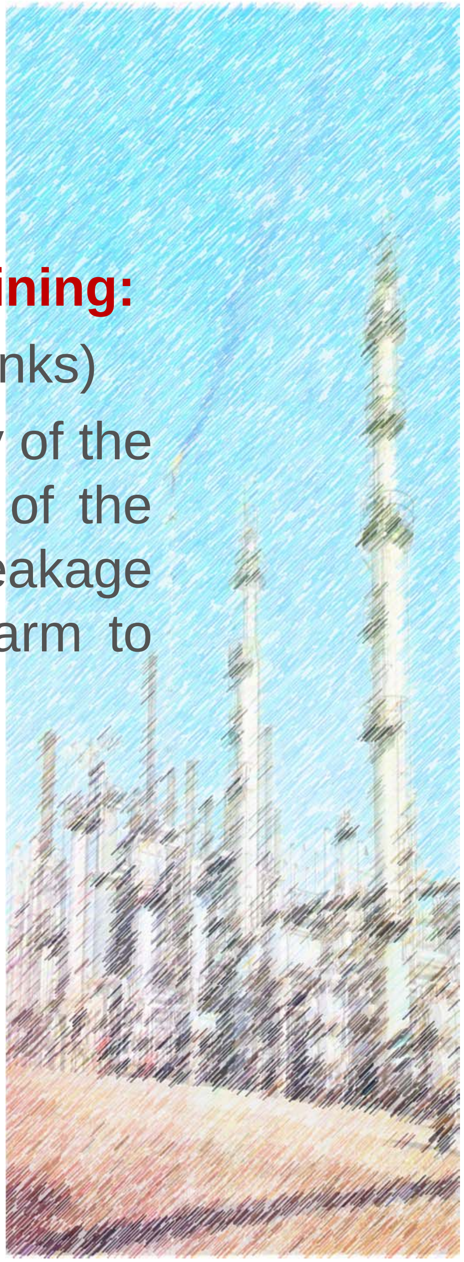
Is it enough? Providing that it is supported by specific operating instructions



- **Example 2: Developing operating instructions defining:**
- **The inspection strategy** (in this case atmospheric tanks)
  - Aimed to periodically check the structural integrity of the single tank, check the degradation phenomena of the main component, so as to minimize the risk of leakage of the contained product, which could cause harm to people and the environment

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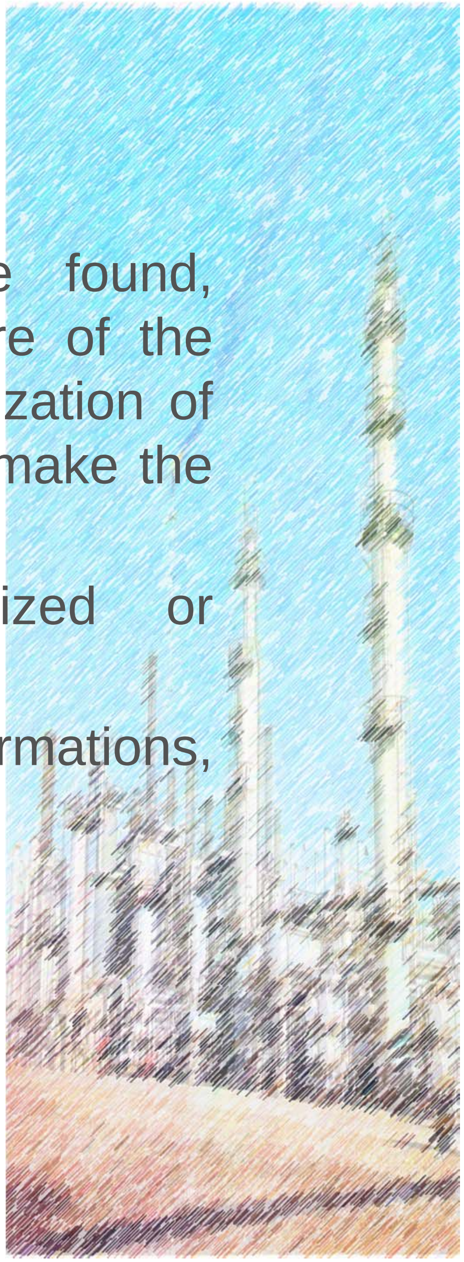
- **The mechanisms of degradation**
  - The degradation mechanisms that can be found, depending on the type of tanks, on the nature of the stored fluids, which are the basis of the organization of the inspection activities. For example, you can make the following classifications:
    - Corrosion: internal or external, localized or generalized;
    - Mechanisms not related to corrosion: deformations, mechanical breaks, cracks on weld, yielding.



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- **Inspection technologies**
  - In addition to visual inspection, internal or external, the degradation mechanisms affecting both atmospheric tanks and pressure vessels can be identified by the NDT common techniques. For example:
    - Visual Inspection
    - Liquid penetrant testing
    - Magnetoscopy
    - Vacuum box test
    - Ultrasonic
    - Spark test
    - Long Range Ultrasonic
    - Acoustic Emissions

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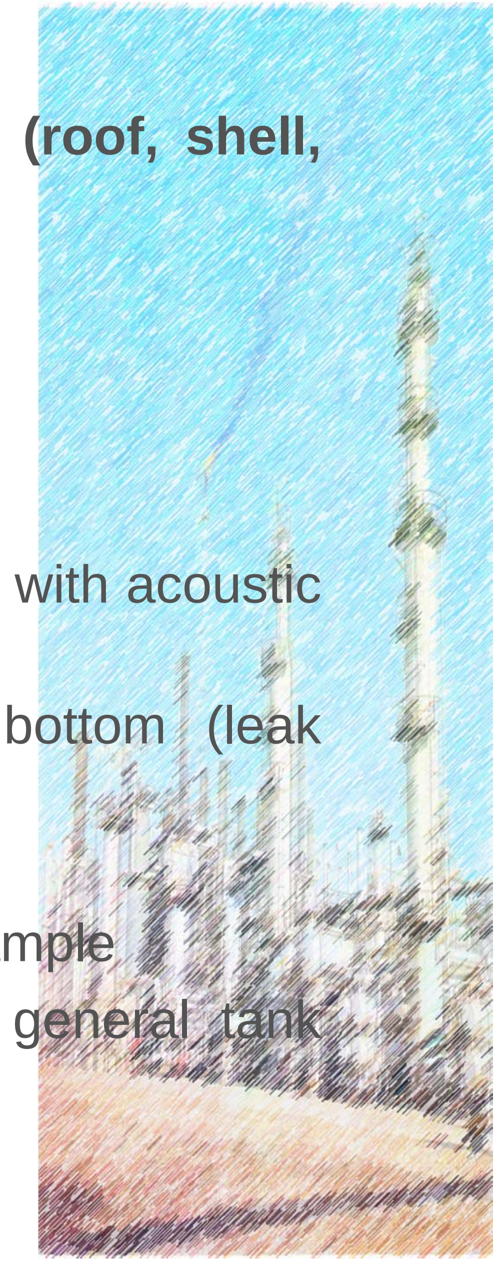

- **The components of the tank to be inspected (roof, shell, bottom, foundations) and type of inspections:**
  - Tank in-service Inspections, for example
    - Routine Inspection
    - Exterior inspection with tank in service
    - Thickness measures with ultrasonic tests
    - Periodic inspection for single bottom tanks with acoustic emissions
    - Periodic check for tanks with double bottom (leak detection and visual inspection)
  - Inspections with the tank out of service, for example
    - Full internal and external inspection for general tank maintenance

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- **Determining the factors that need to be considered to determine the frequency of inspections, such as:**
  - Construction features
  - Repair techniques and materials
  - Nature of stored product
  - Conditions found at the previous inspection
  - Corrosion rates
  - Presence of corrosion prevention systems
  - Potential contamination of soil, water, air
  - Presence of double bottoms or other systems to prevent loss containment
  - Whether or not there are leak detection systems with operating tanks

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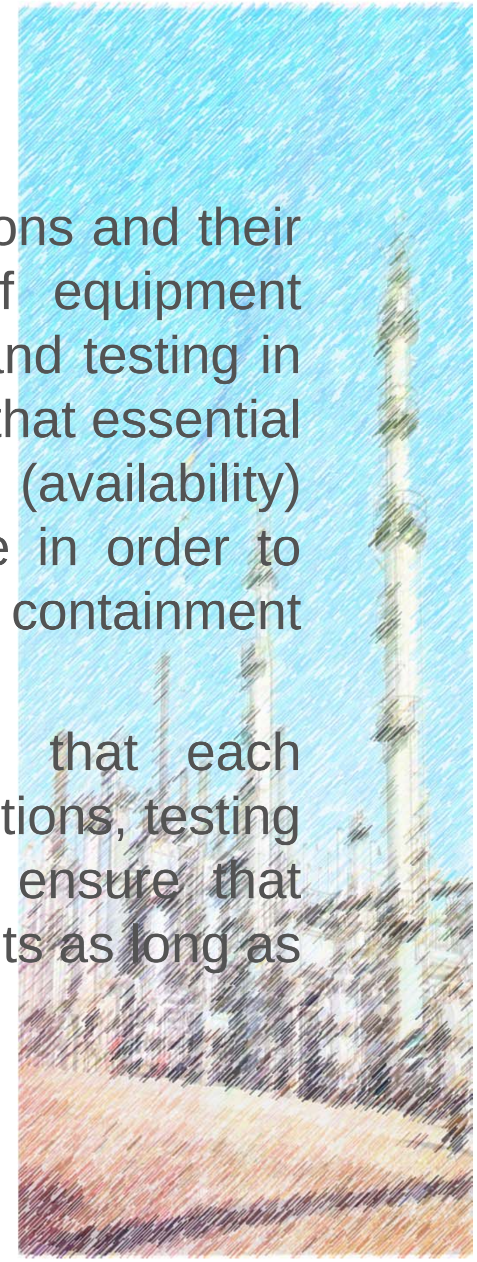
Conclusions and suggestions



- Ensuring sufficient mechanical integrity of site operations and their components requires systematic implementation of equipment controls, in particular, activities such as inspections and testing in order to verify in a timely manner (i.e., prior to failure) that essential operational components maintain their functionality (availability) and suitability for use throughout their operating life in order to prevent failure leading to the occurrence of a loss of containment of a hazardous substance.
- The safety management system should provide that each equipment and utility is subject to a program of inspections, testing and maintenance properly scheduled over time to ensure that these components continue to meet safety requirements as long as they are in service

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- The organization should establish and formalize specific criteria for the determination of the defined maintenance regimes, in particular:
  - preventive maintenance
  - scheduled maintenance
  - predetermined maintenance
  - condition-based maintenance
  - predictive maintenance
  - corrective maintenance
- Establish clear strategy; not just for periodic examination, but for the whole plant lifecycle
- This is especially important on sites storing and processing hazardous substances, where the consequences of integrity failure can be major

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- Based on the Risk Based Inspection (RBI) method, which consists of specific inspection activities according to the actual operating conditions of the equipment, it is possible to schedule a targeted maintenance planning schedule, while through the Fitness For Service (FFS) method you can continue to maintain in operation, with accurate monitoring, equipment that has a structural degradation

- The "Management of Changes" element is crucial, considering the difficulty of identifying new corrosion risks for process and plant design changes and the possibility that other modifications may also have a lesser impact on corrosion risk and therefore not recognized (eg changes in the source of crude oil supply or an increase in production, especially temporary)

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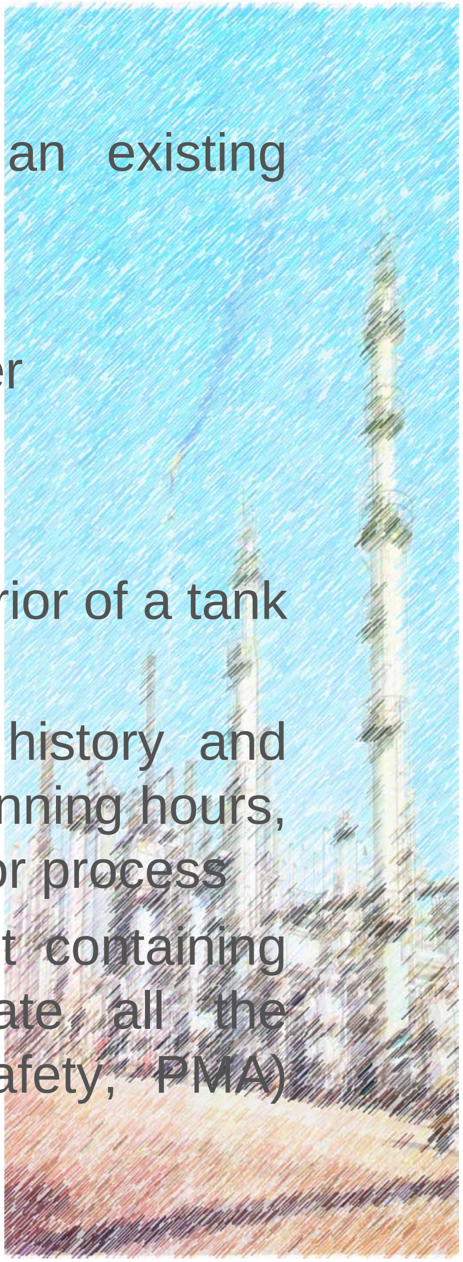

- **Examples of Modifications:**
  - Installing an additional nozzle (or enlarging an existing nozzle)
  - Installing an agitator to an existing vessel
  - Altering the tank / vessel to make it larger / smaller
  - Change of process conditions
  - Retro-fitting steam coils to heat the contents
  - Installing or removing insulation to / from the exterior of a tank / vessel
- It is important to keep records of the operating history and problems encountered during the life. For example running hours, duty cycles, operational excursions, changes in duty or process
- This means that to ensure the integrity of all plant containing hazardous substances, it's necessary to evaluate, all the compliance (occupational safety, environmental safety, PMA) requested, especially the wider duties of COMAH

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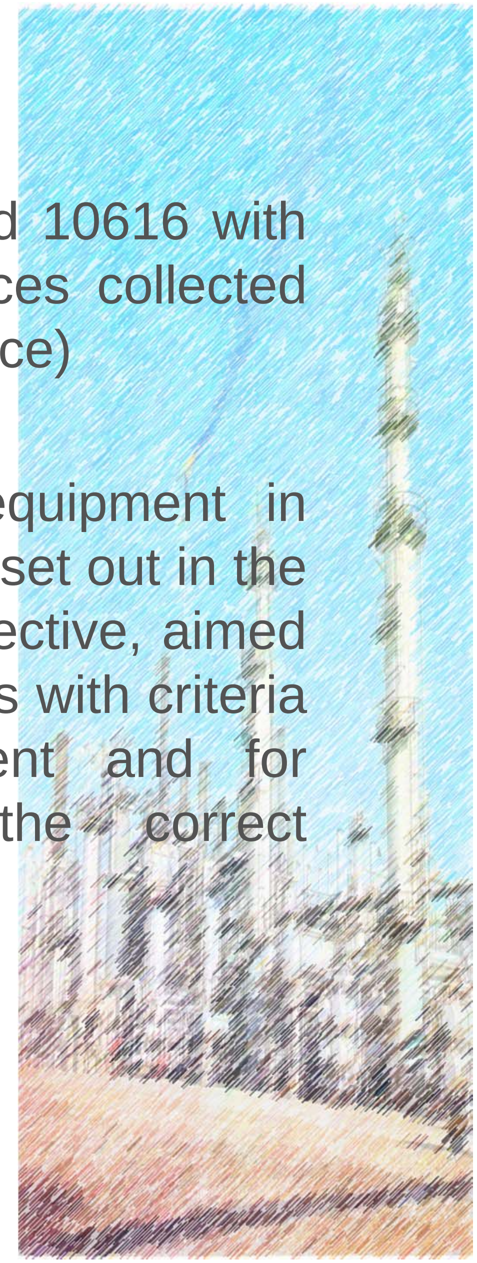
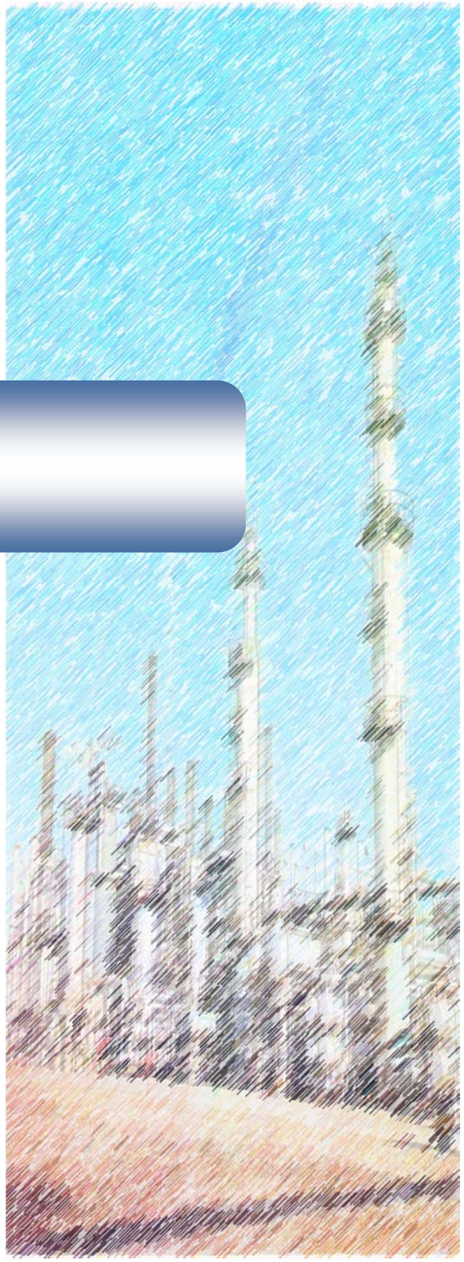
- **To support inspectors / site managers:**
  - Revision project of national standards 10617 and 10616 with specific in-depth studies on ageing (best practices collected around the world and based on historical experience)
  - Technical working group “ageing of critical equipment in Seveso establishments”, as part of the guidelines set out in the Decree on the transposition of the Seveso III Directive, aimed at developing a guideline to provide site managers with criteria for qualitative assessment of their equipment and for inspectors a methodology to evaluate the correct implementation of SMS





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