VisualAIM

Mechanical Integrity Suite

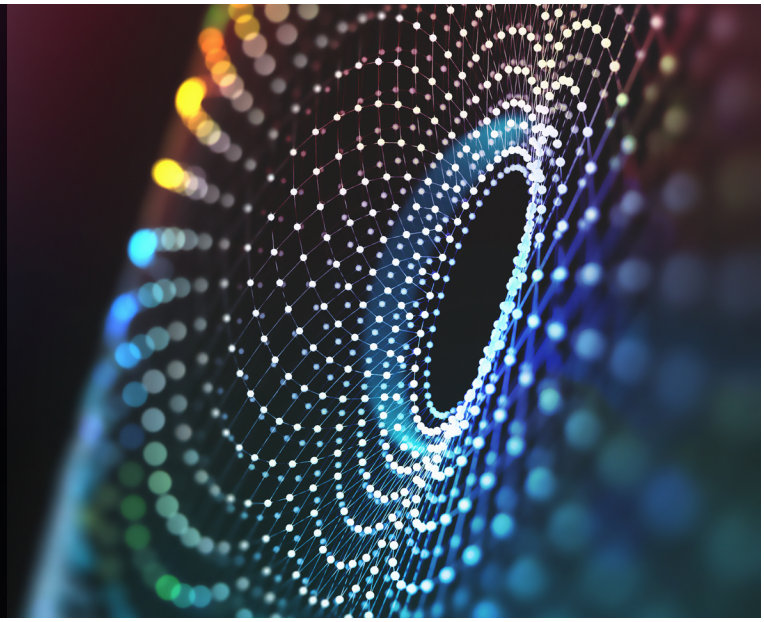
Intelligent Drawing Platform

www.visualaimsoft.com

Contents

Company Profile

> Situational awareness is the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the future.
>
> - Mica R. Endsley, 1998



Our Mission

To enable the human factor to more safely and productively operate and maintain physical assets from within the familiar environment of Piping & Instrumentation (P&IDs) and Process Flow Diagrams (PFDs).

Our Vision

To be the dominant provider of disruptive technology digitally transforming the asset intensive process industries.

Our Values

Safety

Our company provides its services to protect people, the environment, and capital investments. This is why we exist.

Responsibility

We act with urgency and have the courage to change course, when required, in order to build, sustain, and grow our company to meet the expectations of our customers and shareholders.

Service

Our team is dedicated to meeting the specific needs of the programs our customers seek to develop and strengthen.

Innovation

We take pride in our ability to adapt to the evolving needs of our market place and to make use of the right technologies available.

Mechanical Integrity Suite

VisualAIM offers a suite of Mechanical Integrity (MI) Modules for the management, assessment, recordkeeping, planning, and reporting of all activities related to the maintenance and upkeep of fixed equipment in the asset intensive process industries.

As a web application, the MI Suite offers the advantage that all users can collaborate on the platform with merely internet access and proper credentials; in doing so, all information is kept in a single database and all updates can be pushed to the platform with minimum intervention from the IT team.

Developed with direct customer input and user experience in mind, the intuitive nature of the software makes it extremely simple to utilize, with minimal to no training required.

Built with unmatched flexibility, the software allows users to configure almost anything. Define your own process fluids, equipment types, inspection strategies, and much, much more.

Mechanical Integrity

Modules

The MI Suite was developed with an asset-centric philosophy to grant it unique flexibility. The baseline module combination required for use are the Asset Inventory, Structure, and Reports modules.

Mechanical Integrity Suite

Asset Inventory

Overview

The Asset Inventory works as the central hub for asset creation and editing. When accessed, the complete list of assets contained within the database is displayed. It is through this module that the properties for each of the assets can be modified.

Properties

Properties fields are broken down into logical groupings for Identity, Design and Construction, Operation, Process, Minimum Thickness, Asset Evaluation and Suitability for Service, and Susceptibility information.

Asset Classifications

The asset classifications that can be created for API 581 Risk Modeling include Piping, Pressure Vessels, Pressure Relief Devices, and Tube Bundles. For time based inspection planning, the software supports nearly every asset type including fixed equipment, rotating equipment, valves, and instrumentation.

Files

Files can be linked to each of the assets for quick referencing and document management. By having all asset-relevant files in a single location, information is always at your fingertips.

Nomenclators

A key feature that makes the software flexible is the concept of Nomenclators. Asset properties include both free text and drop-down menus for quick referencing. When the default options on the menus do not have client-specific categories, these can be defined with the Nomenclators in the module. The available Nomenclators that can be customized include:

- Asset Classifications
- Component Types
- Construction Codes
- Coating Types
- Cladding Type
- Damage Mechanisms
- Damage Mechanism Properties
- Equipment Types
- File Category
- Geometry Types
- Insulation Types
- Materials of Construction
- Piping Diameters
- Representative Fluids
- CML types
- Inspection Methods

Inspection Work Planning

Overview

The Inspection Work Plan (IWP) module accommodates both Time and Risk Based approaches to inspection management. The Time Based approach requires a minimal amount of information whereas a Risk Based implementation, though more data intensive, tends to yield better results in the long run since inspection scopes can be prioritized for high-risk assets and intervals can be extended if the company risk policy and appropriate standards dictate so.

Strategies

The foundation of inspection plans are the inspection Strategies which are customized for every customer. Strategies align asset types, components, material types, and insulation conditions with damage mechanisms, corrosion types, effectiveness levels, and availability.

Inspection Work Plan

Each inspection plan contains the most relevant information of each asset and the inspection methods and intervals that are configured in the Strategies of the plans. When any new inspection plan is created, it gets logged as a new plan with a new date along with a printable PDF for distribution.

Inspection Work Order

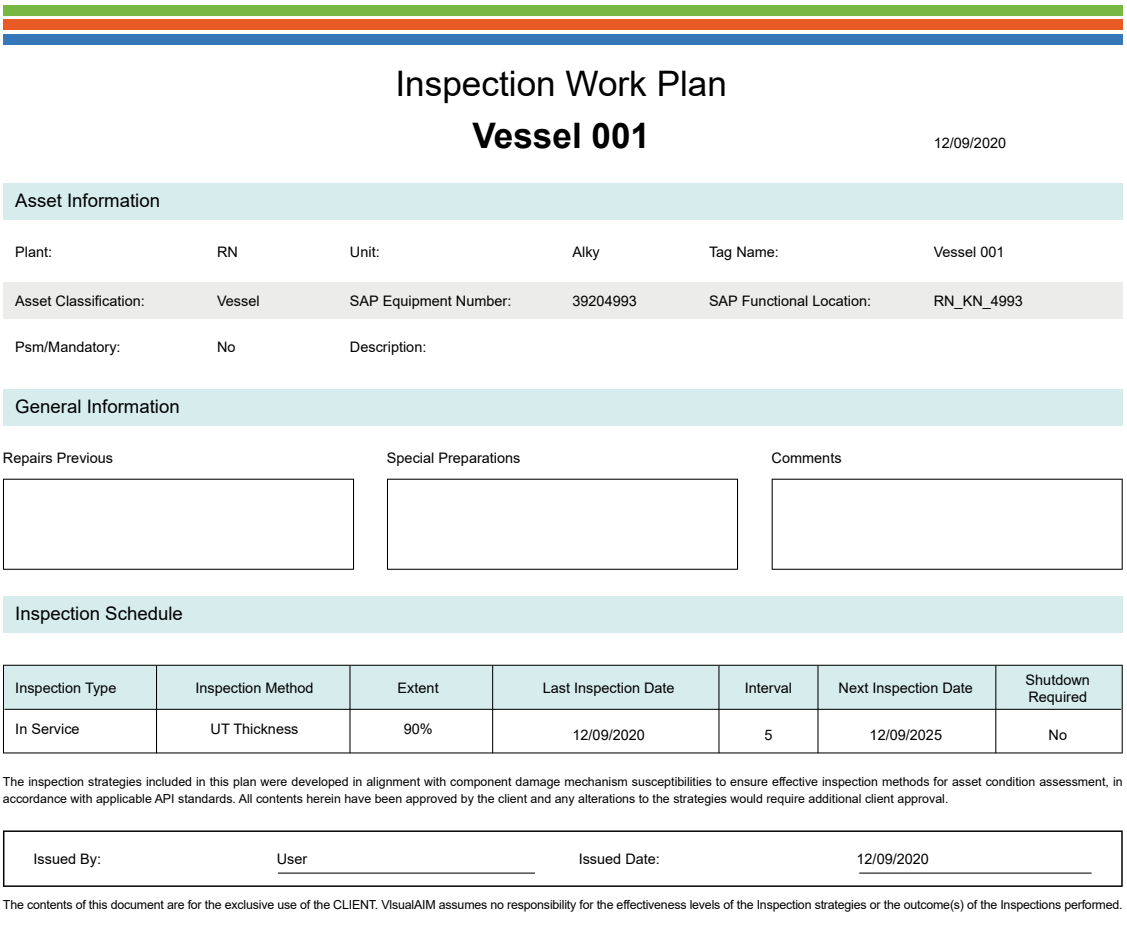
Inspection Work Orders can be derived from the tasks delineated in the Inspection Work Plans. This serves to keep track of the activities completed and the work process includes task completion approvals with signature from admin level users.

Non-Conformance

All Non-Conformances logged in a Previous Inspection entry are tracked separately to have a clear progression of critical repair tasks that must be addressed.

Previous Inspections

After an inspection has been conducted, its record is populated into the Previous Inspection of the asset of interest. The record, which includes the inspection date, minimum thickness, results, recommendations, non-conformances, and associated documentation, serves as the foundation for re-assessing risk and creating the new inspection plan for the asset.



Inspection Work Plan

Vessel 001

12/09/2020

Asset Information

Plant:	RN	Unit:	Alky	Tag Name:	Vessel 001
Asset Classification:	Vessel	SAP Equipment Number:	39204993	SAP Functional Location:	RN_KN_4993
Psm/Mandatory:	No	Description:			

General Information

Repairs Previous

Special Preparations

Comments

Inspection Schedule

Inspection Type	Inspection Method	Extent	Last Inspection Date	Interval	Next Inspection Date	Shutdown Required
In Service	UT Thickness	90%	12/09/2020	5	12/09/2025	No

The inspection strategies included in this plan were developed in alignment with component damage mechanism susceptibilities to ensure effective inspection methods for asset condition assessment, in accordance with applicable API standards. All contents herein have been approved by the client and any alterations to the strategies would require additional client approval.

Issued By: User Issued Date: 12/09/2020

The contents of this document are for the exclusive use of the CLIENT. VisualAIM assumes no responsibility for the effectiveness levels of the Inspection strategies or the outcome(s) of the Inspections performed.

Quantitative Risk Analysis API 581

Overview

The Quantitative Risk module of the MI Suite is a quantitative risk engine that is fully compliant with API 581 risk calculations and methodology.

Probability of Failure

Probability of Failure calculations quantify and combine the damage factors resulting from the 21 potential damage mechanisms contemplated in API 581 which include:

- Thinning
- Component Lining
- Amine Cracking
- Caustic Cracking
- Sulfide Stress Cracking – SSC
- HIC/SOHIC – H2S
- Alkaline Carbonate SCC
- Polythionic Acid Cracking
- Chloride SCC
- HSC – HF
- HIC/SOHIC – HF
- External Corrosion – Ferritic Components
- CUI – Ferritic Components
- External Chloride SCC – Austenitic Components
- CUI – Chloride SCC – Austenitic Components
- HTHA
- Brittle Fracture
- Low Alloy Steel Embrittlement
- 885 F Embrittlement
- Sigma Phase Embrittlement
- Mechanical Fatigue

Susceptibility

Screening criteria for the 21 damage mechanisms are included in the software. Based on the information inputted in the Asset Properties, the software will Automatically flag the damage mechanisms to which the asset components may be susceptible to.

Consequence of Failure

Consequence of Failure calculations quantify the consequence areas and/or financial consequences that may derive from the loss of containment of process fluids; said fluids may be flammable, toxic, or non-flammable/non-toxic all of which include factors that are critical for consequence calculations.

Risk

The product of Probability of Failure and Consequence of Failure results in the Risk of the asset. By default, the MI Suite has the preset balanced risk matrix as suggested by API 581 (see Figure 1), but it can be modified to accommodate the risk matrix utilized by the customer.

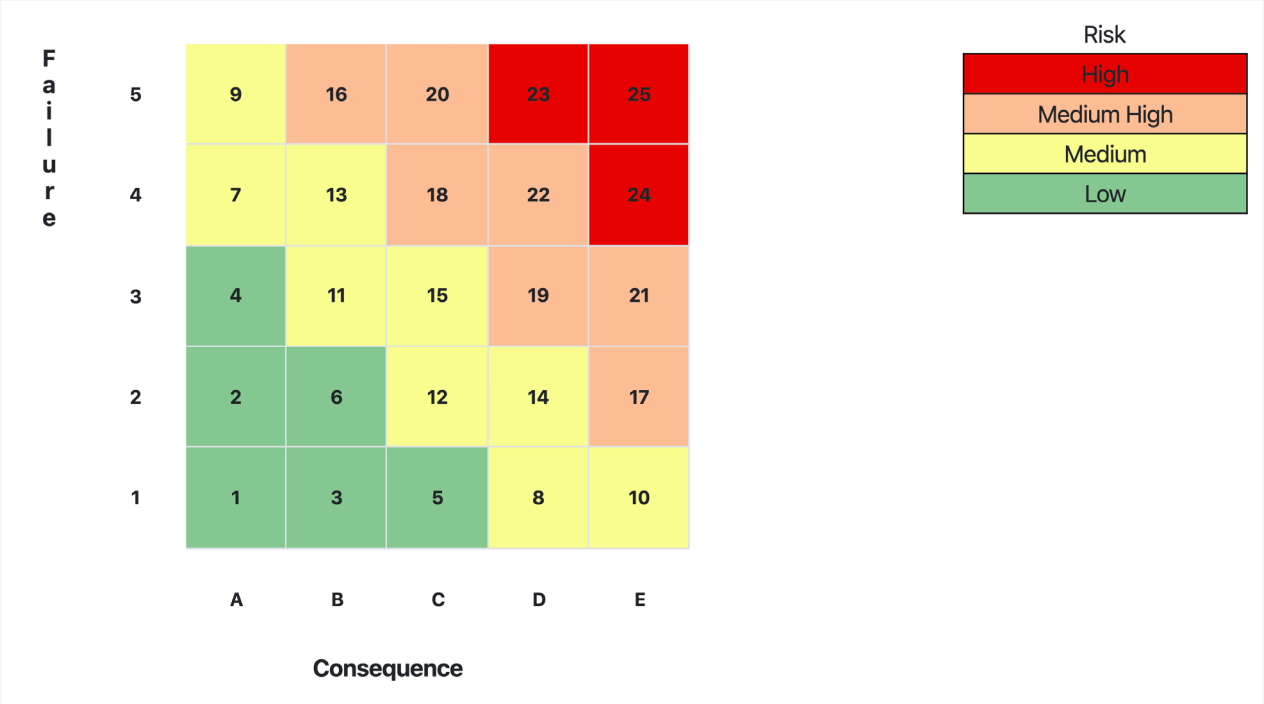
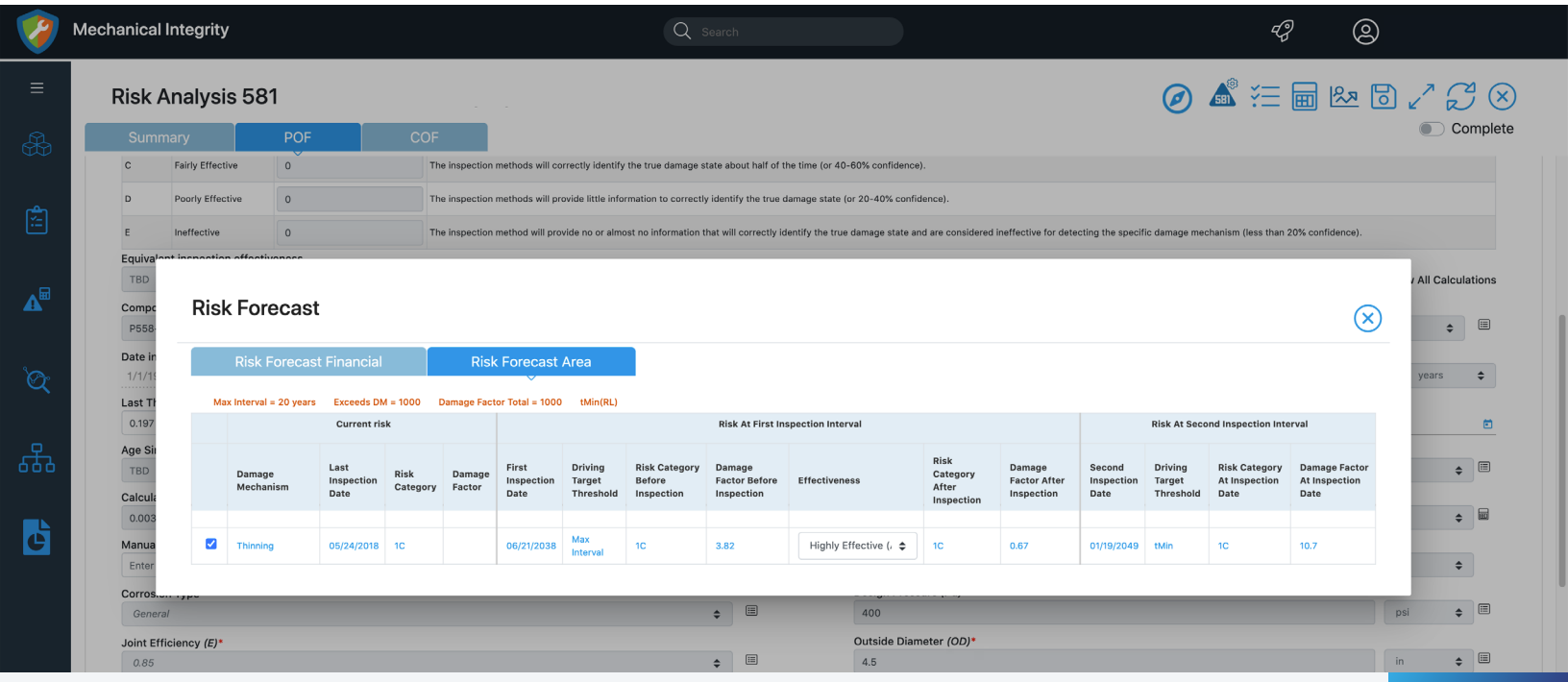


Figure 1: Balanced Risk Matrix

Forecast

Since Probabilities of Failure are a function of time, the risk engine can Forecast what the risk could be for the assets a number of years into the future and, in this manner, provide insight to assets that should be inspected immediately vs the ones that can be left for one or two turnarounds into the future.



Inspection Data Management

Overview

Often termed the NDE (Non-Destructive Examination) Module, the Inspection Data Management Module is designed to capture and keep record of all thickness reading from inspection methods that yield these record types.

CML Properties

CMLs (Condition Monitoring Locations) area defined per asset and within each CML, the properties of the material section can be specified and segregated, along with the location descriptions of each TML (Thickness Measuring Location) on the CML.

Shooter Sheet

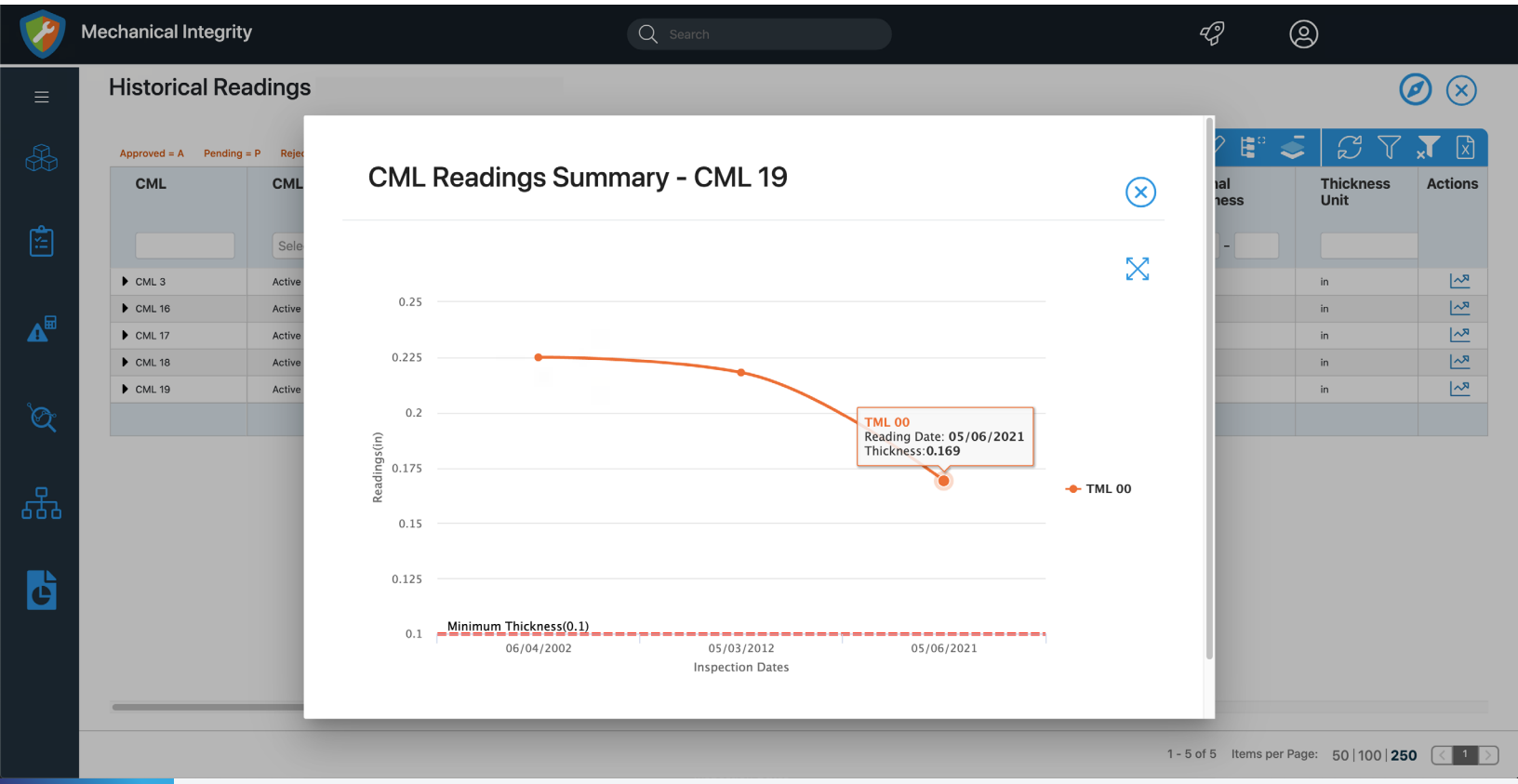
The Shooter Sheet provides a CML inventory and portal through which all the TML readings are input into the module after they have been defined in the CML Properties.

Historical Readings

A thickness reading record is kept for every TML inputted into the software to ensure proper record keeping and to perform corrosion rate calculations.

Calculations

All calculations for short term corrosion rate, long term corrosion rate, minimum thickness, corrosion allowance, remaining life, and half-life are displayed for each of the TMLs defined for the asset of interest. All calculations can be organized and exported in excel or PDF.



Reports

Overview

The Reports module allows all information contained in the database to be queried and visualized in Reports or Dashboards.

Reports

The module contains a set of Pre-Defined Reports that allow for insight into the different MI Suite Modules including:

Asset Inventory

- Audit Information
- Asset by Susceptibility
- Asset End of Life

Inspection Work Planning Reports

- IWP Breakdown
- IWP Latest Inspection Plan
- IWP Past Due Inspections
- IWP Schedule
  - Per Month Summary
  - Per Month Details
  - Per Year
- Inspection Interval Time-Based vs Risk-Based
- Previous Inspections
- Non-Conformances

Inspection Work Planning Reports

- NDE Inventory
- Historical Corrosion Monitoring
- Corrosion Monitoring Information
- Corrosion Monitoring Schedule
- Corrosion Monitoring End of Life
- Archived Corrosion Monitoring

Quantitative Risk 581

- Risk Inventory
- Risk Results by Damage Mechanism
- Assets Exceeding Risk Target

Dashboard

A set of pre-defined Gadgets that allow for interactive and intuitive visualizations of all the data. A properly customized set of relevant graphics can provide powerful and immediate insight into asset conditions and activities progress.

Structure

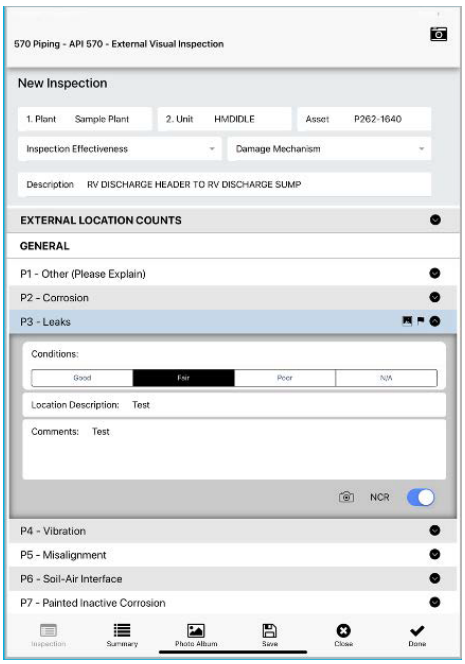
Overview

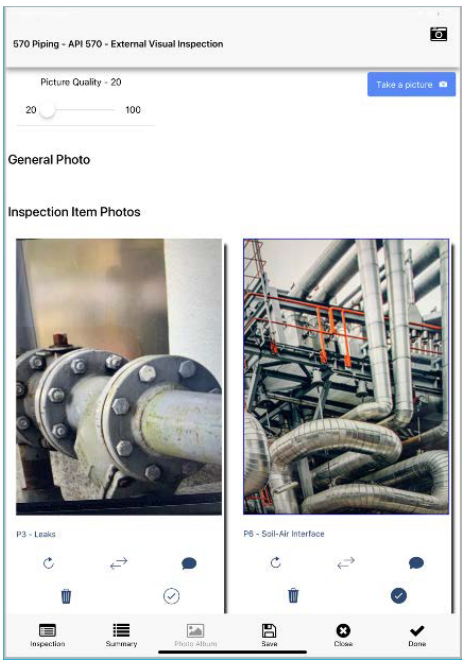
Serves to organize the client enterprise into a Hierarchy by allowing the user to define a Plant, Unit, and System to which assets can be associated in their Identity Properties. This layer of information better organizes assets, enhances their location descriptions, and improves report insights.

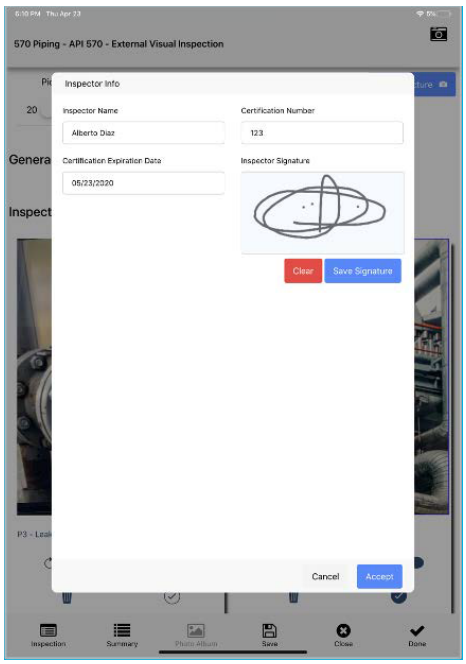
Mobile

Inspection Reporting

Perform API compliant Internal/External Visual Inspections with the added capability of picture-taking and directly synching up/ updating the Previous Inspections for the asset of interest.







Services

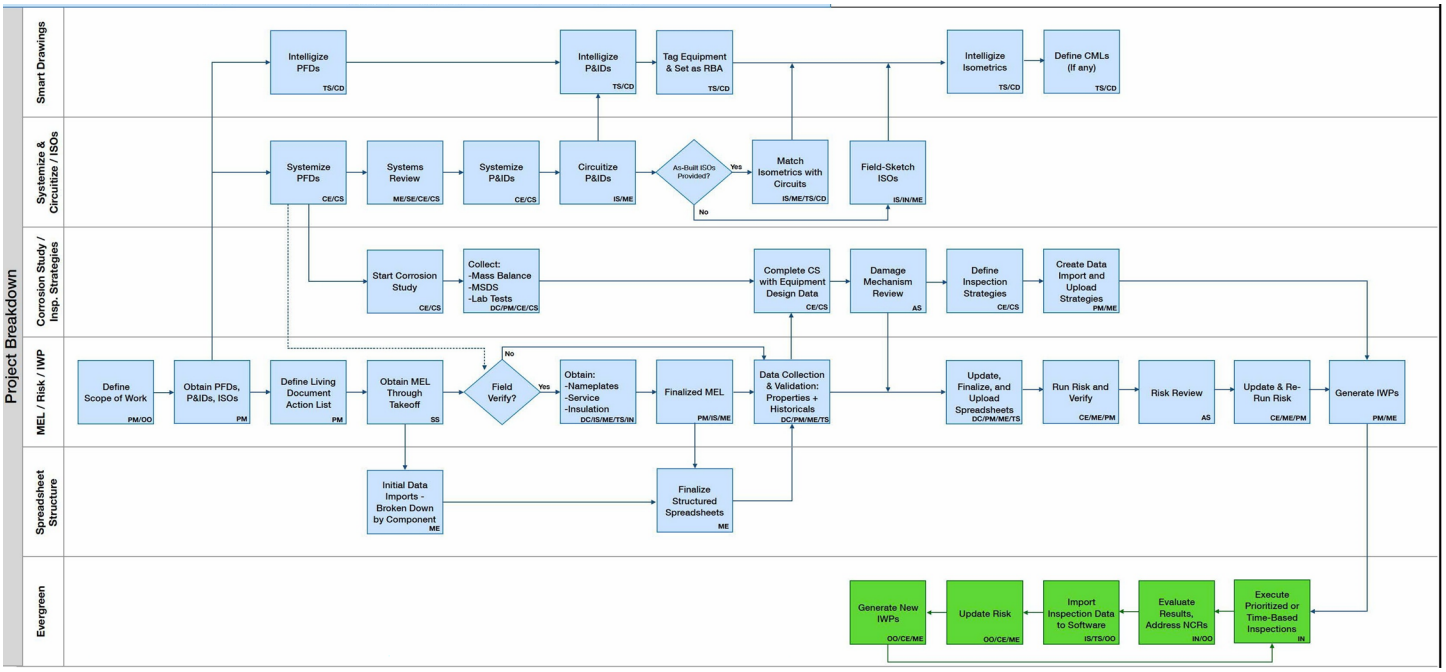
In addition to the software solution, VisualAIM provides all of the services required to assist you in your mechanical integrity needs. With over 15 years of industry experience, our team of experts can help you at any stage of your Mechanical Integrity program.

Our services include:

- Corrosion Studies
- Piping System and Circuit definitions per API 570/574
- Risk Based analysis per API 581
- Data Collection
- Inspection Strategies Development
- Data Migration & Consolidation across systems of record

The workflow shown below shows VisualAIM's main work process for Mechanical Integrity Applications, encompassing the services described above:

VisualAIM Risk Based Inspection Work Process



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