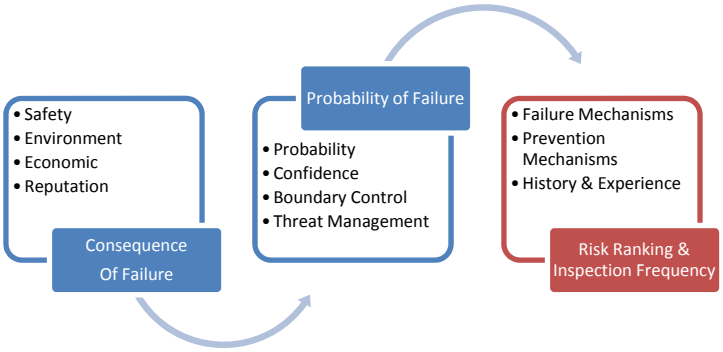
360integrity: Risk Assessment & Criticality Development

What is 360integrity

360integrity integrates Plant Component, Corrosion and Fabric management into a single 'holistic' approach, resulting in enhanced safety, corrosion mitigation and minimised maintenance costs. The 360integrity toolset comprises the Component, Corrosion and Fabric core modules with a number of additional supplementary modules available.

360integrity as a Risk Assessment Tool

Risk assessment is one stage in an integrity management process; the determination of a Quantitative or Qualitative value of risk related to a particular component, or plant item. An assessment requires the consideration of two factors: the magnitude of the potential loss that may result from an item failure, and the likelihood that the failure will occur, the consequence and the probability of failure respectively.

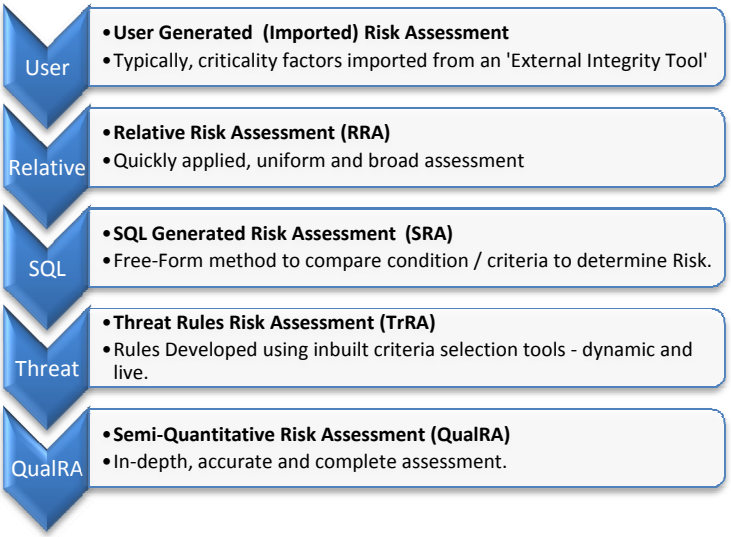


"Ultimately, risk assessment involves the ranking of one asset item against another based on certain comparative criteria."

During an assessment these two factors are 'objectively' considered including any assumptions or uncertainties identified. Defining the consequence of a failure and the probability of its occurrence can often be error prone and difficult to measure. A risk with a significant consequence and a low probability of occurrence must sometimes be contrasted to one with a low consequence and yet a high probability of occurrence, and a prioritisation determined for each. In practice, limited resources can make it very difficult to manage even correctly prioritised risks; often maintenance will be compromised and limited to only certain perceived priorities. 360integrity targets the implementation of a sound and transparent risk management strategy in order to achieve the goal of failure prevention, efficient and cost-effective maintenance and disciplined asset inspection etc.

360integrity Risk Assessment & Criticality Factor Development

360integrity offers several models for the determination of risk, each designed to offer superior results than more traditional methods in guiding us in the prioritisation of Inspection and Maintenance works. Typically the result of a risk calculation is called a 'Criticality' factor, defining priorities on a 1 to 6 scale from 'high' to 'low' respectively. The 360integrity models are outlined here:



User Generated (Imported) Risk Assessment- where criticality factors is managed by some 'other' outside tool or methodology (Coabis, Credo, Acet etc. **All Trade Marks and Names Acknowledged*).

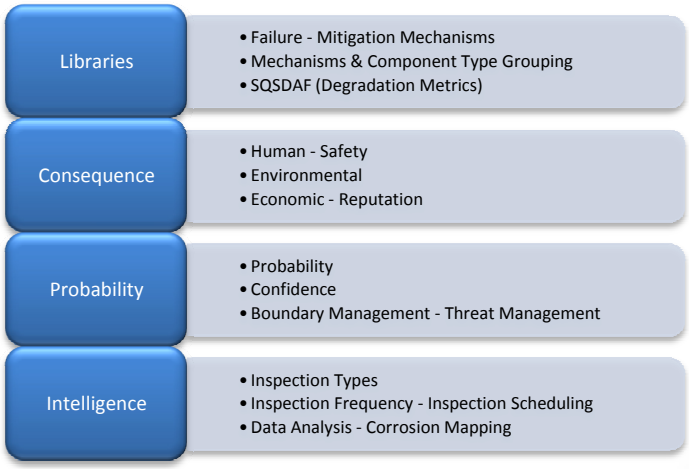
Relative Risk Assessment (RRA). Being a purely 'qualitative' risk assessment, it is a simplified method of setting criticalities and therefore prioritising works for an asset. The method involves answering a number of questions in regards to Risk, Prevention and Consequence resulting in one of two types of Criticality – Static or Dynamic. Often the RRA process is appropriate to quickly build an understanding of risk in a facility, from where it may be expanded using other models.

SQL Generated Risk Assessment (SRA) In traditional models, the data available for consideration to the risk assessment team will often come only from a component database / line list and, possibly, previous inspection results. This cannot be said to be fully flexible in so much as other information, perhaps extraneous to the risk assessment tool being used, such as fabric condition data etc is not easily available.

In 360integrity a 'SQL Generated' criticality offers the ability to incorporate ANY information held on the asset into the calculation including Corrosion, Component, Process or Fabric data. This allows for either plant-wide assessment or 'specialist' application of Criticality's, perhaps with very complex concerns about an asset, where the RRA or QualRA is applied to the remaining plant.

Threat Rules Risk Assessment (TrRA) The ability to create 'rules' based on condition, performance and other criteria, drawn from every aspect of the component, offers the most effective and accurate mechanism to manage risk. This is often seen as an adjunct to QualRA and an overlay on typical, traditional, RBI tools. These rules remain live in the asset database for the life of the component and where / when the rule criteria is breached, an immediate alert is raised. TrRA is a 360integrity innovation and proving valuable in support of RBI or as a standalone tool.

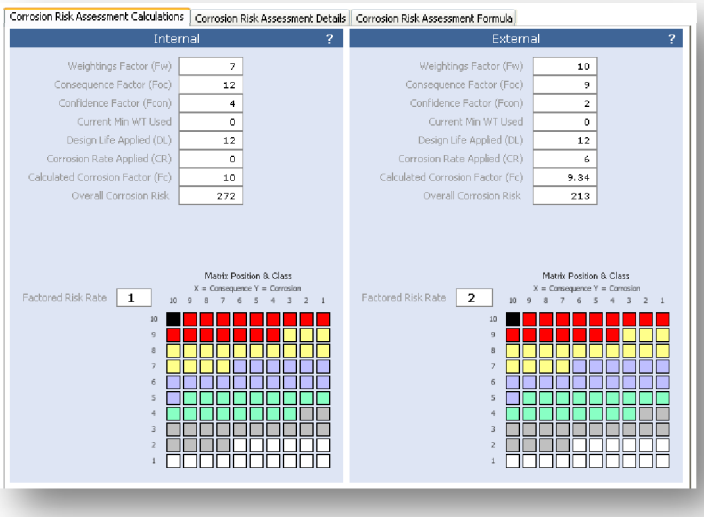
Semi-Quantitative Risk Assessment (QualRA) Where RRA is considered on a component, the QualRA process is able to divide and sub-divide assets into their constituent parts. It may hold a Pipe Class, a Corrosion Loop, a Process, a group of components or even each discrete part of an individual component as a separate element. This process allows a detailed assessment of the asset, and provides a traceable and transparent determination of the criticality attributed to it - in parts and as a whole.



How Does The QualRA Work ?

The application of QualRA is accessed through the Corrosion menu in the Corrosion Module of 360integrity, and the assessment is linked to either a single specific Corrosion record (a pipe feature or measurement point for example) or to multiple Corrosion records, perhaps representing an entire component. Where a single component has been calculated to show multiple Criticalities i.e. it has multiple item parts or has a number of measurement points, the Component page in 360integrity will always demonstrate the 'worst case' recorded criticality factor.

There are 3 tab-pages shown under the QualRA menu; 'Corrosion Risk Assessment Calculations', 'Corrosion Risk Assessment Details' and 'Corrosion Risk Assessment Formula'. The first page is shown here and demonstrates the separate calculation of Internal and External risk criteria.

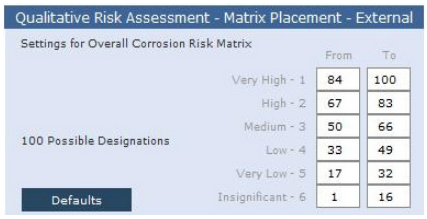


Corrosion Risk Assessment Calculations This page shows the output of a QualRA and the 8, Client customisable, calculated criteria used to calculate the 'Factored Risk Rate'; (the 'Criticality'). At the bottom of the page is a 100 element, 10*10 matrix, some of which are coloured. Since a graphic of complex information is almost always easier to grasp than a series of numbers, this demonstrates two key pieces of information:

1. The position of the 'black-element' in the matrix indicates the significance of 'Risk' calculated, the higher the matrix position (the cell number) then the higher the prioritisation of this component or item for inspection, maintenance or other consideration.

2. The specific colourings for the matrix elements are customisable (as shown in the screenshot here) to specific types of asset, or any of the 100+ component types held in the type library. Significance can be matched to a Clients own 'Corrosion Management Strategy' or procedures.

Because of this colour-coding ability, demonstration of sub-prioritisation can be shown. For example a 2" pipe and a 24" pipe may have similar Criticality calculations because of the process conditions or product they contain; however it may be appropriate to consider small-bore pipes (because of lower wall thickness tolerances) to be of a higher priority ahead of larger diameter pipes, all other aspects of condition being the same of course. From the placement of the black square in the matrix - in relation to the colouring's, an immediate 'big picture' of the priority of the item in terms of Criticality / Concern becomes obvious..

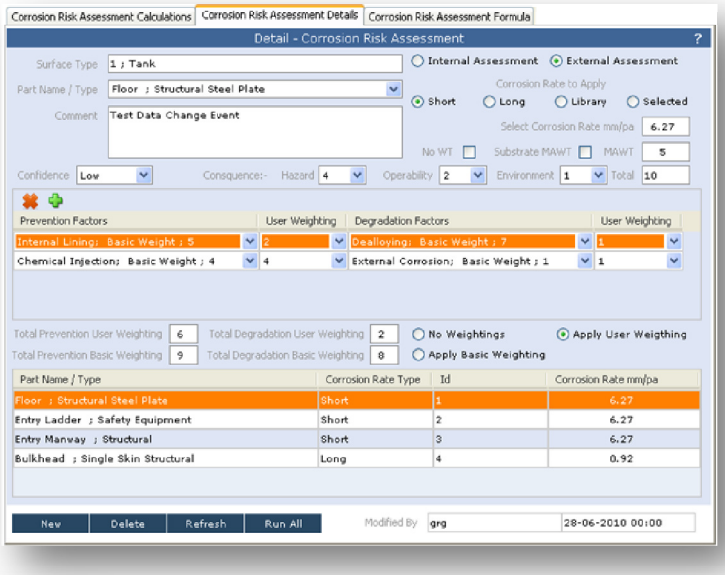


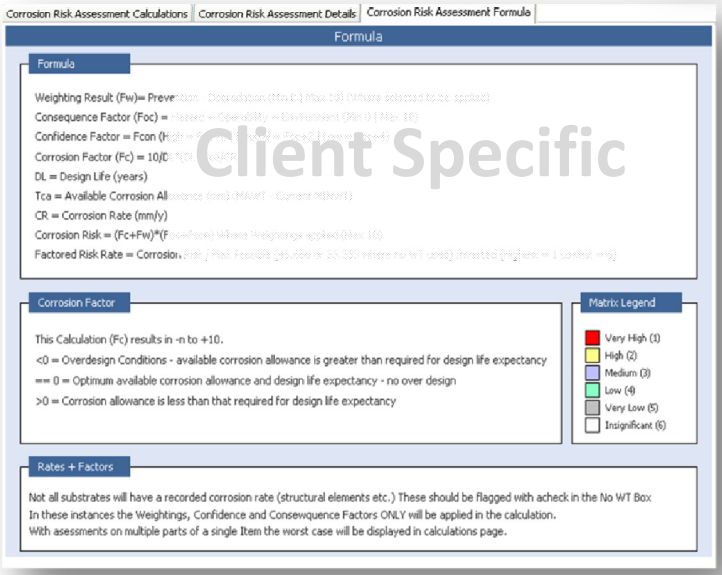
'Why 10 * 10 matrix rather that the more traditional 5 * 5?' *Deployment of risk assessment tools is often to mature assets, in some cases more than 15 – 20 years old. In some cases there is so much inspection and maintenance work highlighted by the risk ranking tool, with a similar prioritisation, that it becomes physically impossible to undertake the works in an acceptable time scale. The challenge for management of those assets is always to, not only prioritise, but to sub-prioritise and often to sub-prioritise again. Whilst attempting to determine where to target maintenance works inevitably some work is mis-prioritised and failures occur. This is exacerbated by the traditional 5 by 5 matrix, which is exceptionally limiting when attempting sub-sub-prioritisation. With the 10 * 10 matrix model, even those components or items with the same overall Criticality may be easily (and automatically) demonstrated to have a sub-prioritisation possibility.*

Corrosion Risk Assessment Details. This is where the assessment is developed; the data used is typically reviewed by an assessment team made up of specialists in appropriate disciplines, who consider the possible failure and prevention mechanisms for this component, group of components or part item. With the team approach the component history, types and frequencies of inspections and the inspection techniques to apply are considered and recorded; inspection techniques recommended will be suggested to the inspection personnel at the point of delivery.

At the top of the form we can see the Surface Type, however directly below that is the facility to select one of the parts that have been identified as making up this component, item or asset. The entire assessment process is controlled and archived with traceable links to decisions and changes made throughout the life of the asset or assessment.

Quantitative Risk Assessment Formula This page shows how the assessment calculations are made and the meaning of the relevant entries in the Internal / External Calculations page. The page is shown here though the figures are for demonstration purposes only, the actual calculations may be customised by the end user Client Admin.

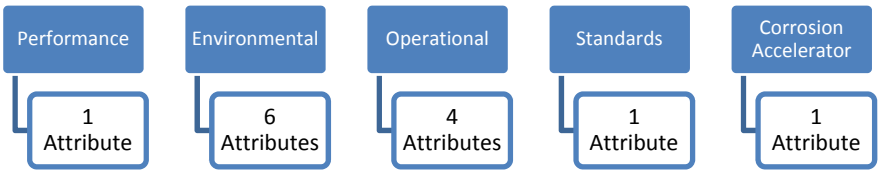




SQDA Factor

The SQDA (Semi-Quantitative Substrate Degradation Assessment) is a measure of the anticipated rate of *'external corrosion and corrosion protection'* associated with components and plant assets. The quantification and rate of substrate degradation is a critical factor in determining where threats to facilities may exist and when maintenance will be most cost-effectively, and safely, undertaken. Within the context of the SQDA classifications there will be a point at which the condition of the substrate is shown to be unacceptable (in terms of integrity) to the operators, stakeholders or integrity authority. That is the point beyond which the substrates must not be allowed to degrade further; the current condition and the rate of degradation offers us the potential to identify when that point will be in the future. 360integrity can apply the SQDA in combination with all of the other integrity data to offer a significant and effective look ahead for the planning and scheduling of inspection, maintenance or a planned replacement programme. These tools in combination allow a 'run-to-ruin ' strategy to be adopted where redundancy or decommissioning might be the target for some sections (or all) of the facility.

The 360integrity SQDA methodology uses quantitative data from 5 categories of influence in order to determine, with accuracy, the current rate of degradation and that anticipated in future. The five categories and the number of attributes considered in each is shown in the graphic here.



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SCM Specialist Services:
· Consultancy & Training (Fabric & Corrosion)
· Auditing & Benchmarking (Fabric & Corrosion)
· Arbitration, Failure Analysis & Testing
· Material Selection & Project Management
· The Effectiveness Audit, A GAP analysis & Bench Marking service
· ECMS External Corrosion Management Solutions (Annual & Lifetime)

SCM Specialist Products:
· 360integrity, the holistic integrity management system
· RISCm Risk, Integrity & Strategic Corrosion Management Control System
· RISCm(FM) External Corrosion & Fabric Maintenance Management System
· SafeMark Range of Markers
Pipe Contents, Cable, Fabric Maintenance, Isolation, Monitor Point and Safety