Taking the pain out of requirements management and traceability

Long gone are the days when you could just get a plot of land, bolt some equipment together and call it a plant. Nowadays a plant has to be designed and maintained in accordance with a wide range of requirements, imposed by numerous authorities and standards bodies. Owner/operators also have to demonstrate how they identified each requirement and how it is implemented in the plant (“traceability”). An effective requirements management and traceability tool should ensure cost-effective regulatory compliance and support change management and the construction, operation and maintenance of a plant.

In the past plants were smaller, regulations were fewer and owner and contractors could meet around a conference table. In those days, RMT could be implemented using standard office software such as spreadsheets and word processing documents. However, these tools are inappropriate in today’s environment. They cannot cope with the number of requirements, cannot effectively define relationships between the requirements or deal with changes to requirements, and cannot provide audit trails. Hence there is a clear need for RMT software, which should preferably be tightly integrated with an enterprise engineering software suite to improve efficiency.

Drivers for the introduction of RMT software in the process industries are:
- growth in regulations
- need to demonstrate compliance to regulators
- larger, more costly and more complex plants
- plant engineering/procurement/construction involving many parties, worldwide
- expansion of process safety management and asset integrity programs
- need for better management of change to avoid rework and overruns.

Recommendation for implementation

The implementation of a RMT solution starts by identifying the requirements using a document decomposer. This software component can process Word, RTF and structured PDF files, as well as any other file format which can be converted to RTF. Essentially, the decomposer treats documents as containers holding requirements. It allows subject specialists to go through all relevant documents and highlight the requirements in them. These requirements are then assigned a unique
identifier based on a configurable numbering scheme. The subject specialist also classifies each requirement (such as regulatory, functional, performance, safety) and enters other data such as a description or priority.

Internal company requirements are identified in the same way. These may include design specification documents, design control documents or the design basis. Once the requirements have been identified and entered into the system they are reviewed and approved. The next, and essential, step is to relate the requirements to each other and to aggregate them where required. The requirements are also related to design basis items such as design specification items and items in the plant configuration like units, systems, and tags. When requirements change, the defined relationships are traced to clearly indicate the impact of the changes on the engineering design basis. Any property changes and relationship changes are date/time stamped and identified by user to provide a complete audit trail for traceability.

Once the data is entered into the system, demonstrating regulatory compliance and traceability is relatively straightforward as all the information is available through the system RMT solution and its data analysis tools.

A key issue in RMT is that requirements — internal or external — may well conflict with each other. Such conflicts need to be resolved at an early stage so that the design can progress efficiently, and avoid unnecessary redesign effort. This may require further analysis of the requirements or discussions with the stakeholder who contributed them. At the end of this stage, all requirements should be captured, clearly defined, unambiguous and compatible with all other requirements.

RMT solutions also reduce the amount of time wasted addressing questions such as “Are we sure that’s the appropriate component?”, “Why are we doing it this way?” and “Who changed that?”. Improved relationships with the authorities (and insurance company inspectors) during inspections and investigations, and the ability to answer their questions promptly and correctly are also major benefits. It is a valuable tool for the management of change.

The management of change is facilitated as regulatory requirements and design requirements are managed together. This means the impact of an envisaged plant modification can be analyzed quickly, as can the implementation in the plant in terms of systems, structures, and tagged components — simply by following the relationships managed in the system.

Bringing all together

One of the solutions in the market that provides data relationships between the requirements and the engineering design basis is Intergraph SmartPlant Enterprise for Owner/Operators (SPO) software.

Stakeholder requirements

A requirement has changed
What’s affected?

The design is changing...
are requirements still satisfied?

Engineering design basis

The management of change providing bi-directional impact analysis between requirements and the engineering design basis Source: Intergraph 2014 / Picture above: BASF

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suite, which includes packages for all aspects of process plant design, operation and management. The SPO Requirements Management and Traceability Solution (SPO RMT) package integrates tightly with the work processes supported by the rest of the suite and ensures that data only needs to be entered once. SPO RMT builds on and uses the engineering design basis managed in the SPO core solution.

The tool creates a direct link between every requirement or design criterion and the affected plant systems, structures, and components (SSCs) and associated documentation. This makes it straightforward to identify requirements which have not yet been met ("orphan requirements"). Similarly, the impact of any changes to the requirements or the design basis can easily be identified. Consequently, owner/operators can reduce the costs of ensuring full regulatory compliance, while at the same time improving the safety and efficiency of their operations and practicing better change management.

There are also efficiency gains from the integration with other Intergraph SPO solutions such as SPO Project Execution, SPO Systems Completion, and SPO Operating Plant. Using such highly automated solutions throughout the lifecycle of a plant, from initial design through to decommissioning, can give owner/operators effective and efficient control of plant data at all stages, hence reducing costs while improving safety and efficiency. In a broader context, SPO RMT supports industry-standard taxonomy structures such as the Electric Power Research Institute (EPRI) plant information model as well as proprietary structures. Although RMT may have its roots in regulatory compliance, as part of an integrated software suite it offers opportunities to build, operate and maintain a plant more efficiently and safely.

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This article originally appeared under the title "Painkillers" in the October 2013 edition of Hydrocarbon Engineering. For further information with respect to efficient requirements management visit www.intergraph.com