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isiONE is a software-based solution specifically developed by Innomerics for managing Reactor Pressure Vessel internals. incorporating all relevant documents, requirements and decisions into a single, homogeneous tool

isiONE software provides utilities with cuttingedge technology intended to coherently organize all information and decisions that are relevant for RPV internals. isiONE helps nuclear power plants fulfill the materials aging and degradation management guidelines of NEI 03-08, and, in the case of Boiling Water Reactors, the requirements of BWRVIP-94NP.

Thanks to its multiple advanced functionalities, specifically developed for RPV internals management, isiONE:

- Serves as a central repository for plant configuration information, including design bases, as-built geometry, materials and fabrication records.
- Provides tools for documentation and analysis of applicable BWRVIP requirements.

- Serves as a repository for operating experience related to RPV internals.
- Documents all inspections, providing access to inspection records, procedures and reports.
- Generates inspection reports for complying with BWRVIP reporting requirements and demonstrates compliance with BWRVIP Guidelines.
- Provides tools for inspection planning.
- Provides tools for mapping, trending, and plotting degradation and other component conditions.



Sample isiONE view: 3D component model and related drawing

isiONE software provides easy access to design basis information and inspection data for engineering and maintenance teams involved in Reactor Pressure Vessel internals inspections, assessments, repairs, modifications and long-term asset management decisions

Management of multiple content.

isiONE compiles and organizes various sources of information that are critical for RPV internals management. These sources of information are frequently scattered among diverse media that may be missed due to access difficulties or lack of maintenance. This information includes multiple types of contents and formats, such as:

- Design bases drawings, technical specifications and calculations.
- As-built drawings and specifications, design modifications and repairs.
- Documentation related to inspection requirements, regulations, guidelines, operational experience.
- Inspection history, including registries and results, along with their evaluations.
- Planning of future inspections.

Using various tools and forms, additional layers of information and metadata can be added in isiONE, e.g., interactive markups, links between documents, indication records, inspection logic, statistics.

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Diverse uses and applications.

The contents and functionalities available in isiONE effectively assist NPP owners in different engineering and maintenance functions relevant to RPV internals management, in-service inspections, assessments, repairs, modifications and asset management decisions. Examples of these uses and applications of isiONE are:

 Knowledge management, improving program continuity if RPV internals program owners change roles, as well as interaction with external suppliers.

Improved plant configuration control.

 Demonstration of compliance with program requirements and appropriate consideration of operational experience.

• Efficient scheduling of inspections according to applicable requirements.

• Sound evaluation and trending of inspection results.

 Effective identification of affected documents when inputs change or related operational experience is identified.

 Quantitative inspection data that can be compared to fleet inspection trends.

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- Component tree panel organized under tree structure Data panel to access relevant information associated with component
- 3D navigation panel • Properties panel showing model layers of information

Sample isiONE view: BWR 3D component and related data panels

In the case of Boiling Water Reactors, the advanced functionalities of isiONE offer specific support in complying with NEI 03-08 and the BWRVIP Program, in a way that is effective, cost-efficient and demonstrable to third parties

Structure and functionalities.

isiONE organizes contents under a component tree structure, according to the nomenclature followed by the plant. This structure, coupled with an intuitive user-friendly interface and high levels of security and traceability, contributes to usability.

isiONE offers multiple features and functionalities specifically aimed at supporting utilities in key RPV management applications, including:

- 3D visualization of components and inspection areas with typical CAD features and links to relevant information.
- Organized access to documents associated to each component and inspection area: interactive drawings, inspection datasheets, RPV-related reports, analysis forms (document applicability, inspection bases, materials, indications analyses), inspection history and planning tools, compliance reports and flowcharts...
- IVVI visualization and editing functionalities (e.g. growth of indications through different outages).
- · Analytics and reporting capabilities.

BWRVIP ad hoc solution.

isiONE is aimed at helping NPPs fulfill with the materials aging and degradation management guidelines of NEI 03-08, and, in the case of BWRs, with the requirements of BWRVIP-94NP, in a way that is effective, cost-efficient and demonstrable to third parties.

isiONE brings together different sources of BWRVIP-relevant data within a single, traceable system. Its implementation and use entail (and are proof of) an extensive evaluation of design bases, as-built configuration, evaluation history, inspections, reactor internals repairs and existing operational experience stemming from the BWRVIP Guidelines.

The structure and functionalities of this software have been specifically defined and developed to support and evidence compliance with the BWRVIP requirements, namely:

- Plant configuration awareness.
- Fulfillment of inspection requirements.
- Documentation of inspections.
- Reporting requirements.
- Inspection planning.



isiONE software at Cofrentes Nuclear Power Plant: CASE STUDY



Cofrentes Nuclear Power Plant. Cofrentes is a Boiling Water Reactor NPP (BWR-6) located in the region of Valencia, Spain, in operation since 1984. The plant is owned and operated by Iberdrola. Cofrentes NPP is a member of the BWRVIP Program, and it has committed to fulfill the BWRVIP requirements, as part of its Life Management activities.



BWRVIP compliance and sound RPV internals management. and management.



(described more later) has been followed.



Regulatory and operational benefits. plant configuration control, inspection planning and analysis.



As part of its 2014-2018 Management Plan implementation, Cofrentes NPP planned to build a detailed RPV internals database. This database is intended to ensure and provide evidence of compliance with BWRVIP requirements, as well as to become a key tool for RPV internals inspection

isiONE software for RPV internals database implementation.

In order to build this database Cofrentes NPP selected isiONE. a software specifically developed to support RPV internals programs, providing a unified information repository and workflow tool. Of the implementation options available, a two-stage turnkey approach

isiONE is providing Cofrentes support in complying with BWRVIP-94NP, along with a powerful operational tool that facilitates effective, cost-efficient aging management of RPV internals, through knowledge management,

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The implementation of isiONE at Cofrentes assist the plant in managing its RPV internals program according to BWRVIP-94NP

Background.

Cofrentes NPP is a member of the BWRVIP Program, and it has committed to fulfill the BWRVIP requirements, as part of its Life Management activities. As part of its strategy to meet these requirements and reach its desired standards of excellence, Cofrentes decided in 2014 to implement improved procedures and tools aimed at ensuring and providing evidence of compliance with BWRVIP-94NP.

Cofrentes has included in its 2014-18 Management Plan the development of a detailed database for in-service inspection purposes, aimed at effectively identifying the vessel internals inspection areas and the applicable requirements under the BWRVIP Program.

In order to build and use this database. Cofrentes has decided to implement the ad hoc RPV internals management system isiONE, on the basis of both product considerations (features and functionalities specifically relevant for RPV internals) and industry-specific expertise of the Innomerics team involved.

Architecture and implementation.

The isiONE version implemented for Cofrentes NPP consists of two core applications, server and client (end-user). The former organizes documentation in a centralized manner under a hierarchical structure based on BWRVIPrelevant parameters. The latter allows for efficient access to and use of information by end-users. The client application includes tools and functionalities that meet the specific needs of teams involved in RPV internals inspections, assessments, repairs, modifications and asset management.

In order to implement its RPV internals database using isiONE, Cofrentes has adopted a two-stage approach. First, a group of high priority internals has been selected, based on their condition, risk of degradation and need for medium term action planning. Secondly, the project has been extended to the remaining relevant RPV internals.

Among the different implementation and licensing options available, a turnkey solution approach has been followed at Cofrentes



In addition to the compliance motivation, the application of isiONE at Cofrentes serves broader operational purposes

Regulatory and operational benefits.

Although the implementation of isiONE at Cofrentes was initially driven to a great extent by compliance considerations, operational benefits have been emphasized as the implementation project has progressed. Examples of relevant uses and applications, other than compliance support and demonstration, are:

- Knowledge management, ensuring continuity in the RPV internals program, and facilitating engineering work related to RPV internals.
- Improved plant configuration control.
- Efficient programming of inspections according to applicable requirements.
- Sound evaluation of inspections results.
- Effective identification of affected documents when inputs change or related operational experience is identified.
- · Potential for benchmarking of operational practices vs. inspection trends with other BWRs.

Features and functionalities.

isiONE version for Cofrentes offers multiple tools and functionalities specifically aimed at supporting the plant in key RPV management uses and applications, including:

• 3D visualization of components and inspection areas with typical CAD features and links to relevant information.

 Organized access to documents and metadata associated to each component and inspection area: interactive drawings, inspection datasheets, RPV-related reports, analysis forms (document applicability, inspection bases, materials, indications analyses), inspection history and planning tools, compliance reports and inspection logic flowcharts...

Tabulation of indications.

 IVVI visualization and editing functionalities.

Analytics and reporting capabilities.

Virtual inspection module.

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Other isiONE relevant information



Structural Integrity Associates, Inc. / Innomerics team.

Structural Integrity and Innomerics have collaborated to combine the best-in-class capabilities of the isiONE software platform developed by Innomerics with Structural Integrity's extensive BWR RPV and Internals management experience to provide our clients with an unprecedented tool to facilitate management of the increasingly complex inspection and evaluation requirements for RPV internals. Structural Integrity has been providing BWRVIP support to utilities since it's inception, combining the Innomerics technical team which has over 14 years of engineering experience, and a head software developer with vast experience in software development and implementation all within the nuclear industry.



Continuous technology evolution.

The isiONE team is committed not only to sound software performance, effective implementation and continued value-added support to isiONE users, but also to user-fueled evolution of isiONE including, as an example, the recent addition of an industry leading virtual inspection module and image editing functionalities.



Implementation flexibility.

isiONE can be implemented under different scopes and approaches, ranging from complete turnkey projects covering all RPV internals and historic records, to phased implementation projects limited to specific groups of internals and/or inspection periods, to stand-alone software licensing.



Quality assurance.

The Structural Integrity Quality Assurance (QA) Program complies with the requirements of 10CFR50, Appendix B, 10CFR21, and ANSI/ASME NQA-1-1989, 1994, 2008/A2009, and meets the intent of applicable portions of ANSI N45.2. Innomerics is an ISO 9001 certified company. Its activities in general, and isiONE software and implementation in particular, follow a quality assurance program that is consistent with rules ISO 9001:2008, UNE 73401:1995 and UNE 73405:1998.



isiONE software demos.

Further information about isiONE software features and licensing, as well as on the Cofrentes case study presented in this document, are available upon request. In addition, isiONE demos can be scheduled to provide hands-on experience.



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