

SHARED RESEARCH PROJECT

Corrosion Under Insulation

INFORMATION FOR PROJECT SPONSORS

Corrosion Under Insulation (CUI) is prevalent on plant both on and offshore, including nuclear and chemical plants, oil refineries and offshore installations. Developments in coatings, insulation materials, cladding systems and installation practices have led to some improvements, however the unpredictable nature of CUI, combined with the associated difficulties of inspecting for and subsequently detecting anomalies, makes ongoing integrity management extremely challenging.

Consequently, CUI continues to represent a major safety threat, having been responsible for a number of major hydrocarbon releases and presenting industry with a range of business assurance/continuity challenges that carry with them significant costs each year.

This project considers CUI from a lifecycle perspective. Through an empirical work programme, the aim is to further develop our knowledge and understanding, resulting in safer, more reliable and efficient operations.



HSE SHARED RESEARCH PROGRAMME

HSE has a longstanding history of supporting science and research to address a range of cross-sector safety issues. Building on this heritage, the HSE Shared Research Programme provides a platform to identify and co-fund applied research projects that are of interest to both industry and regulatory bodies.

Overview of Technical Work Packages

This shared research project will be delivered as a series of distinct, but interrelated, work packages. The specific details will be defined and agreed on a collaborative basis via the steering committee. The work will be led by scientific and engineering specialists at HSE, supported by their regulatory colleagues and using sub-contractors, if appropriate. An outline work programme is provided below.

WP1: INSIGHTS AND INTELLIGENCE FROM DATA

The aim of this work package is to better extract value from data; unlocking previously unobtainable insights and intelligence to help inform how to prevent/manage CUI more effectively.

It is expected that this work package will be conducted in two phases. Phase 1 will take the form of a state of the art review, establishing prior work conducted in this area, the techniques adopted and key conclusions. Where there is considered specific merit in doing so, data analysis techniques applied in analogous areas will be summarised with respect to their potential applicability to the CUI case.

Phase 2 will include the design and implementation of a data sharing framework. CUI related data sets will be gathered from the project partners, and other parties as appropriate, and steps taken to ensure that the combined dataset is anonymised and desensitised. The framework will consider the necessary process steps, including how to assemble, organise, analyse and visualise the data.

For the data analysis step, informed by Phase 1, consideration will be given to both manual and automated techniques, providing a platform to actively engage with a range of solution providers to maximise the potential to unlock data relationships and data-driven insights. Data visualisation will be used to display complex data relationships in a way that is accessible and easy to understand. Workshop sessions will be held to discuss the findings and consider how the data insights can be used to establish the most common root and contributory causes and optimise current approaches to preventing/managing the threat posed by corrosion under insulation in service. Whilst the emphasis will be on acquiring insights and intelligence from existing data sets, consideration will also be given to the viability of a more long-term, sustainable platform for sharing data on this important topic.

Deliverables

- State of the art review detailing prior work, methods used and key outcomes.
- Framework for the exchange and subsequent analysis of data sets.
- Report summarising the outcome of the data analysis exercise, including data relationships and data driven insights derived from engaging with a range of solution providers.
- Report detailing how the insights and intelligence may be applied with respect to preventing/managing CUI via the workshop sessions.

WP2: LIFECYCLE MANAGEMENT - CURRENT APPROACHES AND PRACTICES

The aim of this work package is to establish current good practice with respect to how the threat of CUI is managed from a lifecycle perspective.

It is anticipated that this will be identified through the sharing of knowledge and experience amongst the project partners, in conjunction with reviewing any pertinent documentation. With respect to existing guidance and good practice, a structured approach will be adopted, considering the key elements of Plan; Do; Check; Act, and how these have influenced company approaches and procedures. All relevant documentation will be reviewed on an independent and confidential basis and benchmarked against existing guidance, detailing areas of notable commonality and variance in approach. A series of workshop sessions will be held to discuss the outputs of the study and provide a forum to identify good practice from the common features and justifiable approaches. Where appropriate, it is anticipated that partners will be able to modify their existing procedures to reflect the good practice identified as part of the work package.

Deliverables

- Report summarising existing guidance and good practice.
- Comparison table and accompanying report identifying commonality and variance in the approaches adopted, including benchmarking against existing guidance and good practice.
- Report documenting workshop discussions and outputs along with examples of good practice.

WP3: INSPECTION AND NON DESTRUCTIVE TESTING (NDT) TECHNIQUE VALIDATION

The aim of this work package is to establish the performance and limitations of existing techniques, identify good practice within user-industries and to evaluate the decision-making processes used to underpin inspection approaches.

It is anticipated that this work package will be conducted in two phases. The first phase will take the form of a state of the art review. Information sources will include previously conducted validation and verification studies, as well as operational experience solicited from the project partners, literature and wider consultation. As part of the review process, steps will also be taken to identify concurrent research initiatives and, where appropriate, forge links to avoid duplication. A key outcome of Phase 1 will be establishing the capabilities and limitations of applicable techniques, as well as drafting a prioritised matrix of work to address any identified knowledge gaps.

In Phase 2, the focus will be on implementing the prioritised work programme defined in Phase 1. Given recent developments, two key areas of focus will be sensor technologies, coupled with a refreshed look at the merits of close visual inspection. A flexible approach will be adopted, with the potential for undertaking empirical trials alongside the generation of high-quality, visual guides and information sheets.

Deliverables

- State of the art review detailing the strengths, limitations and resolution of currently available inspection techniques, along with an overview of operational experience/perspectives.
- Report detailing the test reference specimen trials, including efficacy of sensor technologies.
- Close visual inspection lookup chart.

WP4: SYSTEM PERFORMANCE

The aim of this work package is to establish the relative susceptibility of different configurations to CUI.

It is expected that this work package will be conducted in three phases. In Phase 1, a review will be conducted to establish the existing state of the art with respect to trials development, test infrastructure and the performance of different configurations. In Phase 2, a matrix covering key variables such as coating type, insulation system, etc. will be developed in consultation with the project partners and the broader supply chain. With reference to the outcome of Phase 1 and using design for experiment principles as appropriate, a prioritised test matrix for empirical trials will be agreed. Phase 3 will focus on the design and manufacture of the test infrastructure, informed by Phase 1, as well as conducting the empirical trials detailed in the prioritised matrix developed during Phase 2.

It is envisaged that this work package will be undertaken with reference to the requirements of WP3, acknowledging that it is likely the empirical trials will provide a platform to test the efficacy of a range of inspection/sensor technologies.

Deliverables

- Review detailing the current state of the art with respect to trials development, test infrastructure and the performance of different configurations.
- Prioritised test matrix of configurations.
- Report detailing the results of the test reference specimen trials.
- Report contextualising new experimental work and findings with outcomes from state of the art review.



WP5: ENSURING A QUALITY INSTALLATION

The aim of this work package is to establish the key elements that lead to a quality installation, alongside reviewing any currently available training and competency frameworks.

It is expected that this work package will be conducted in two phases. In Phase 1, task analysis techniques will be used to establish the key task steps of a typical installation along with any interdependencies. To identify the potential for human failure, it is anticipated a number of on-site installations are observed. This will identify the tasks that need to be carried out along with key roles, responsibilities and accountabilities. It is anticipated that subsequent analysis will provide an opportunity for task optimisation. The emphasis will be on the tasks undertaken at the point of installation, although consideration will also be given to the impact of the pre-installation and post decision making processes.

In Phase 2, existing training and competency schemes will be reviewed. Any differences in the approaches adopted by and within various industrial sectors will be identified, providing an opportunity for knowledge transfer and the promulgation of agreed good practice.

Deliverables

- Report detailing the outputs and conclusions from the on-site task analyses, including opportunities for task optimisation.
- Report outlining existing training and competency schemes, industrial take up and relevance, and notable variations in approach.

WP6: KEY LEARNINGS AND DISSEMINATION

The aim of this work package is to document the agreed good practice generated as a result of the project.

It is expected that the good practice will be underpinned by the outputs and experience gained from undertaking work packages 1 - 5. A workshop session will be held to discuss and finalise content, based on the outputs of the work programme.

Given the prevalence of existing guidance material, it is expected that the intent will be to raise awareness of the output with relevant parties for consideration in future updates of their respective publications, in preference to publishing an additional standalone guidance document.

Deliverables

- Report documenting agreed good practice.



PRICE AND DURATION

HSE is seeking participants to contribute £75k [£25k per year] to become a project sponsor. It is anticipated that the project will start in 2024 and will take 3 years to complete.

For further details please contact **Chris Scales:**
E: christopher.scales@hse.gov.uk

