Case Study: Reflections on a Major Nuclear New Build Project from Concept to Commissioning

Emma Ridsdale

RPS

SUMMARY

The paper highlights the implementation of relevant good practice Human Factors Integration (HFI) methods on a major nuclear new build project. The Human Factors (HF) team have provided support to the design and safety case since 2017. HF activities have assessed the role of the operation, allocation of function and analysed the proven technologies selection and input into novel design solutions to deliver a safe, operable, and functional design.

KEYWORDS

Human Factors Integration, Nuclear New Build, Design

Introduction

One of the most complex challenges facing the UK nuclear industry is tackling the nuclear legacy waste and managing spent fuel from nuclear power stations to enable them to continue to operate. One specific challenge is the management and the safe disposition of the inventory of the UK's Special Nuclear Material (SNM).

The storage of legacy SNM packages across the Nuclear Licensed Site presents an intolerable risk due to the potential loss of containment if a single package were to fail. To manage this risk, the SNM will be transferred into new packages for storage in existing modified facilities. To achieve this mission a specialised new build facility was required to receive, repackage, and, where appropriate, re-treat all the SNM packages into a form suitable for safe and secure long-term storage. This major facility is classified as a National Strategic Asset.

The facility includes a mixture of automated and manual systems: A transfer system to receive and export packages, several gloveboxes with combined manual and automated processes to re-treat and repackage material, intermediate stores and a Main Control Room.

Human Factors Integration: Major New Build Project

HFI is the process to ensure that HF is considered in a proportionate, risk informed manner in design and safety assurance. As a practice and principle, HFI is enshrined within the Office for Nuclear Regulation (ONR) Safety Assessment Principles (SAPs) for Nuclear Facilities' [Ref. 1], namely via SAP EHF.1 which requires that:

SAP Engineering Human Factors.1 (EHF): A systematic approach to integrating HF within the design, assessment and management of systems and processes should be applied throughout the facility's lifecycle.

Therefore, it is important to consider HF as a distinct element of the engineering design process and safety case, which must be recognised, assessed, and managed effectively, to control risks to As Low As Reasonably Practicable (ALARP) and support development of appropriate strategies to ensure the role of the operator is appropriate.

It is widely accepted that early and timely engagement of HF provides the best opportunity to ensure that the delivered design is safe, operable, cost effective and supports human performance. HF professionals engaged as part of the multidisciplinary team at the start of the project allow the earliest opportunity to define and substantiate the role of the operator within the overall mission of the project.

Reflections on HFI

Noting that the importance of early HFI is well understood, this paper presents personal reflections from the HF Manager on the successes and how challenges have been overcome to ensure that consideration of HF is sustained throughout the project lifecycles. The presentation discusses: what happens once HF is included early in the design?

The nature of the project set-up: The key to achieving HFI is setting up effective engagement strategies with all relevant stakeholders of the project so that appropriate time, resource, and awareness is given to HF, e.g., tailored and proportionate HFI Plan, HF Issues and Assumptions Register, co-located one teams approach, early involvement of Pre-Operations Teams and Suitably Qualified and Experienced Personnel (SQEP) multidisciplinary project team.

HF Input to the design: The identification of HF issues during the early phases of a project has led to effective design, safety, and operability solutions to be identified, allowing any changes to be made prior to construction and installation and avoiding foreclosure of design options. This is significantly less costly than back fitting design changes at a later stage and provides confidence that the functionality of the design supports the end-users.

Organisational Structure of the HF Team: There has often been debate on the best fit for the HF team: Safety or Design/Engineering. Within this project the HF team report to the Safety Case Team, which along with other factors aided HF input during the development of the safety assessments, e.g., correct designation of operational claims, confidence in their achievability and ensuring clear wording. However, the tagline "Safety starts with design" is recognised as a fundamental principal by the HFI Manager and potentially being reportable to the Engineering Department may have driven smoother collaboration throughout the design and commissioning planning stages.

Relationships: Behaviours and attitudes adopted by the HF team are pivotal to ensuring full understanding of the design and operators' perspective, key safety issues, and the timely uptake and input of HF considerations. For example, promotion of HF, training on HF, collaboration, understanding engineering terminology, project constraints and client arrangements, and collaboration has aided this process and active HFI promotion from the HF team members has led to strong and ongoing working relationships with key stakeholders.

Use of common tools to facilitate access to design and safety requirements: HF design requirements were derived from a wide range of HF activities early in the design process and these were integrated with the project requirements database rather than managed separately by HF.

Design requirements have also been instrumental in ensuring early verification and validation of the design and operations and integration into testing plans, again instead of separate testing performed by HF which would increase the programme time and cost.

Benefits and outcomes achieved: Implementation of HF methods has led to successful stakeholder buy-in, operator ownership of the design and realistic and achievable human based safety claims.

References

ONR Safety Assessment Principles for Nuclear Facilities, 2014 Edition, Revision 0.