Task Screening Methodology – A Consistent Approach to Proportionate Human Factors Assessment

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SUMMARY

This paper presents a task screening methodology developed to support proportionate Human Factors (HF) assessment of human tasks within a nuclear construction project involving safety-critical environments. The methodology provides a structured process for identifying the type and depth of HF assessment to apply to tasks. It builds upon existing guidance and is intended to align with regulatory requirements. The paper outlines a five-step process, discusses feedback from application on projects, and highlights areas for future development.

KEYWORDS

Proportionality, Task Screening, Task Analysis, HF Assessment

Introduction

This paper outlines a task screening methodology, developed for a nuclear construction project. The methodology supports proportionate Human Factors (HF) assessment of human tasks within complex facilities, where a large number of tasks and procedures are carried out. Although developed for use in the nuclear industry, the methodology can be adapted to a wide range of projects across safety-critical industries.

The methodology was developed with input from HF specialists experienced across multiple licensed sites and builds upon existing approaches and guidance from client and industry practice. It is also intended to align with regulatory requirements, such as the Office for Nuclear Regulation (ONR) Safety Assessment Principles, 'EHF.1' and 'EHF.5', which call for systematic integration of HF throughout a facility's lifecycle, and for proportionate analysis of tasks that contribute to safety functions (ONR, 2014).

The main purpose of the methodology is to provide a structured, repeatable and transparent process for determining the type and depth of HF assessment required. The approach enables HF specialists to make traceable, auditable, and consistent decisions within and across different phases and areas of a project, to ensure that HF assessments are proportionate to task risk and complexity. The methodology is intentionally designed to be simple and accessible. It offers a clear decision-making pathway based on a holistic view that considers task characteristics together with conventional, operational, and environmental consequences, in addition to nuclear safety consequences. The features of the methodology enable HF specialists to identify hazards and risks early in a project and prioritise safety-significant tasks. This avoids unnecessary depth of assessment for low-risk or simple tasks, while also capturing tasks that may not be safety-significant but are still demanding and warrant HF assessment.

Methodology

The following sections describe the application of the methodology and five-step task screening process.

Application

The methodology is suitable for use at any point of the design lifecycle and can be applied iteratively. However, early application is recommended so that:

- Resultant recommendations, such as design changes, can be implemented.
- Safety-significant tasks requiring detailed HF assessment are identified and prioritised early.
- A high-level task analysis is available to inform hazard identification.

The methodology is most effective when supported by other stakeholders. HF specialists should seek input from subject matter experts (SMEs) with detailed knowledge of task characteristics and consequences. Relevant stakeholders may include safety case authors, design engineers, end users, conventional safety advisors, operational readiness teams, and environmental specialists. Stakeholder engagement will help to ensure error consequences and task characteristics are accurately assessed.

Figure 1 provides an overview of the five-step task screening methodology described in the following sections.

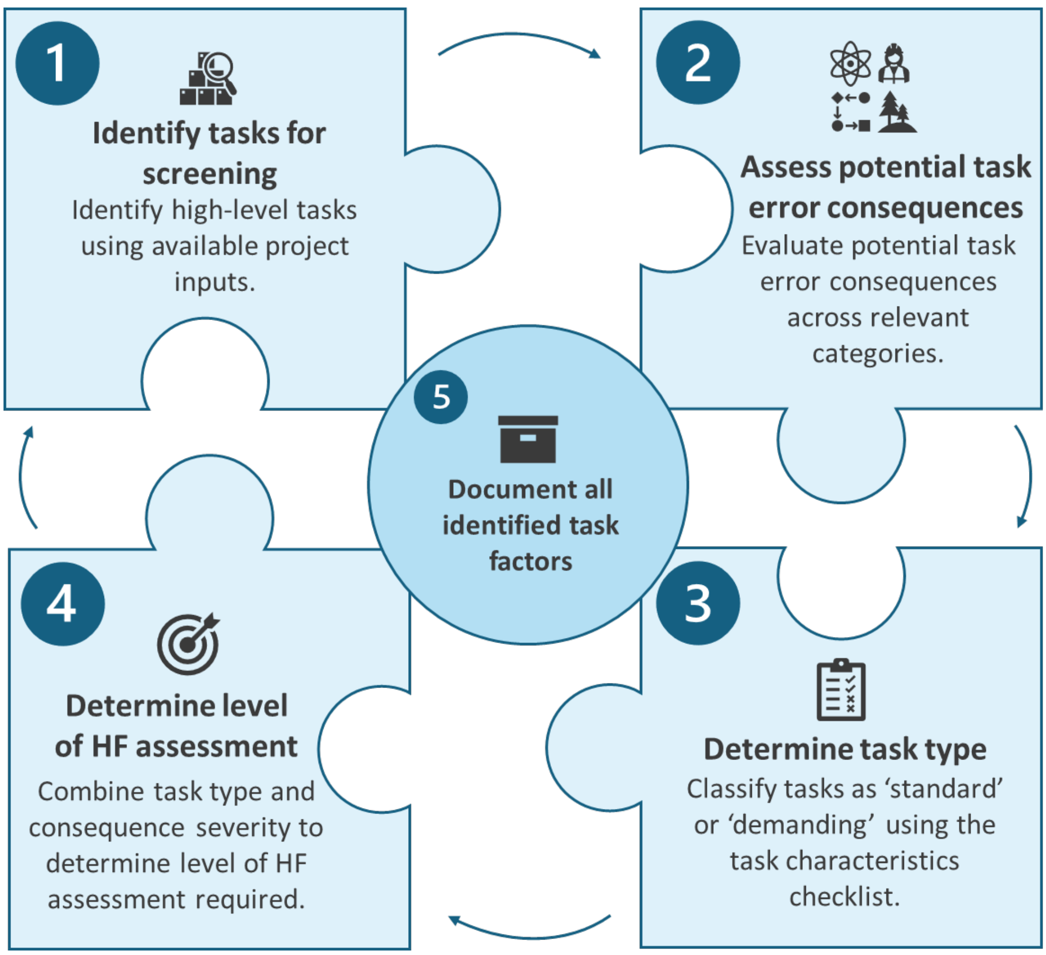

Figure 1: Overview of the five-step task screening methodology.

Step 1 – Identify Tasks for Screening

High-level tasks are identified for screening using a variety of relevant and available inputs such as procedures, hazard analyses, hazard and operability studies (HAZOP), HAZOP briefing packs, mechanical sequence diagrams, and stakeholder workshops. A high-level task refers to an activity or overall goal that consists of several smaller sub-tasks.

The level at which a task is considered 'high-level' is determined by HF specialist judgement and depends on how tasks are structured within a task analysis, since tasks can be decomposed to various levels of detail. As a result, the definition of a high-level task may vary between applications of the methodology.

Step *2 – Assess Potential Task Error Consequences*

Tasks are assessed to understand the potential consequences of an error. The methodology considers four consequence categories, detailed in Figure 2.

Within each applicable consequence category, tasks are evaluated using a three-tier, Red-Amber-Green (RAG) severity system (significant, moderate, and low/none). In no particular order, each consequence category is reviewed independently and assigned an appropriate severity level based on the potential consequences of error within that category. Once assigned, the most severe rating is carried forward and used to inform subsequent steps in the methodology. This ensures that the HF assessment reflects the worst-case potential consequence, irrespective of lower severity ratings in other categories. The Task Screening Matrix (Figure 2) links the consequence categories and severity levels and provides a visual structure to support this part of the screening process.

The relevance of each consequence category can differ depending on the context in which the methodology is applied. For example, operational consequence was a key consideration when the methodology was used for a nuclear facility construction project. In other settings, however, this factor may not carry the same level of importance.

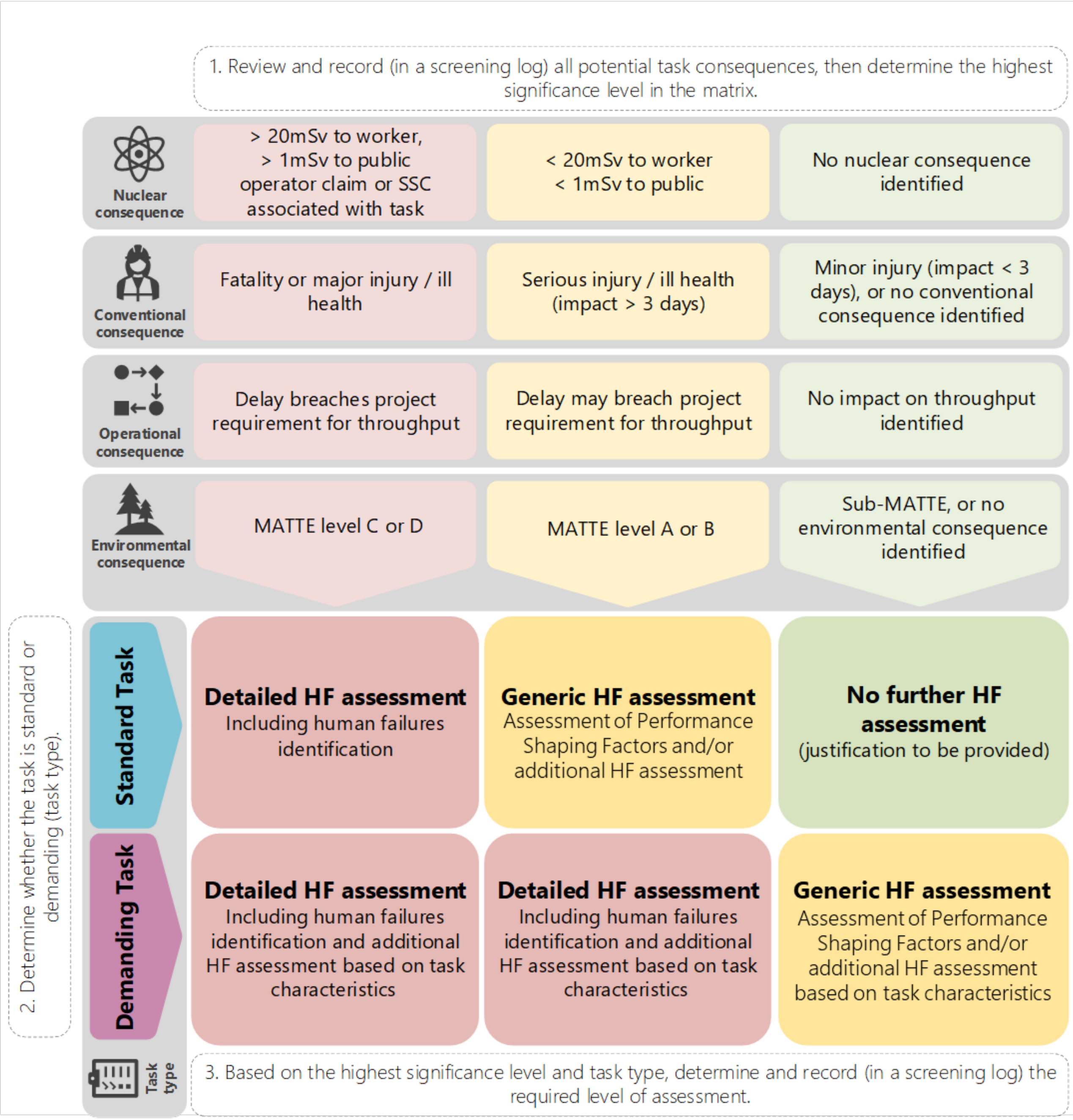

Figure 2: Task Screening Matrix to determine level of HF assessment.

The criteria used to define the severity for each consequence should be tailored to the project, drawing on industry standards, regulations, project requirements and the HF assessor's knowledge. The criteria should be developed with input from specialists who are suitably qualified and experienced in each consequence area, so that the resulting criteria are appropriate. Table 1 summarises the four consequence categories and identifies examples of potential stakeholders to support the development of project-specific severity criteria.

Table 1: Summary of task error consequences.

Consequence Type	Definition	Stakeholder Input
Nuclear	Considers the potential radiological exposure to the public or to a worker, following task error or failure.	• Criticality assessor • Radiological assessor • Safety case author

Consequence Type	Definition	Stakeholder Input
Conventional	Considers the potential for injury or ill-health following task error or failure.	• Fire engineer • Safety, Health, Environment, and Quality (SHEQ) specialist
Operational	Considers the degree to which facility throughput is affected by task error or failure (e.g. asset damage or process delay).	• Capability specialist • Operational readiness engineer • Systems engineer • End users
Environmental	Considers the potential harm caused to the environment.	• SHEQ specialist

Step 3 – Determine Task Type

Based on a predefined list of task characteristics, tasks are categorised as either ‘standard’ or ‘demanding’, helping to identify tasks that place higher cognitive or physical demand on users. For the purposes of the methodology, it is assumed that all tasks are performed by personnel who are suitably qualified and experienced, and capable of completing the task under the expected conditions. The characteristics considered in the methodology include:

- Frequency – how often a task is performed.
- Complexity – how much cognitive, physical, or mental effort a task requires.
- Novelty or familiarity – whether a task is routine or unfamiliar to users.
- Availability of proof in service – whether a task has demonstrated reliable performance.
- Learning from Experience (LfE) – previous incidents or learning that indicate known issues.
- Environmental conditions – whether the environment affects users’ ability to perform a task.

These task characteristics are used along with task error consequences to inform the level of HF assessment required. The checklist in Figure 3 is used to support task characteristic classification. If one or more criteria within the checklist indicate increased difficulty or uncertainty, the task is classified as ‘demanding’. If all criteria fall within expected or routine conditions, the task is classified as ‘standard’.

What constitutes a ‘standard’ or ‘demanding’ task is context-specific and has no universal definition. The classification should be relative to other tasks being screened and the environment in which they are performed. HF specialists can adapt the way in which the task characteristic checklist is applied to tasks through experience on a project and engagement with end users and SMEs.

The characteristics and inclusion criteria in Figure 3 were developed with input from HF specialists experienced across several licensed sites and general working practice. Limiting the method to just two task types (standard and demanding) promotes ease of use and consistent judgement, thereby supporting proportionate HF assessment. Where judgement deviates from the prompts in Figure 3, rationale should be recorded to maintain transparency.

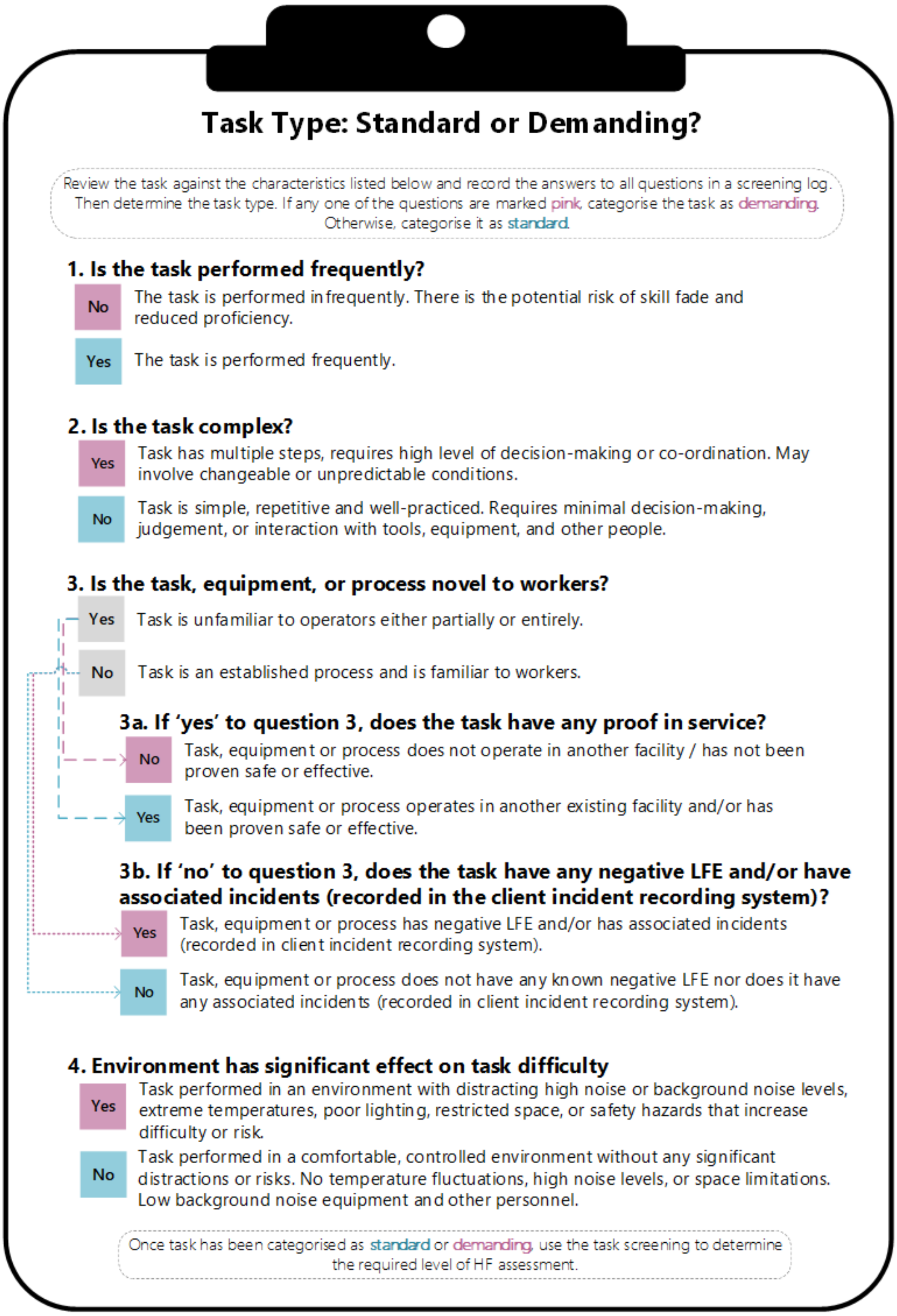

Figure 3: Checklist used to determine task type based on task characteristics.

Step 4 – Determine Required Level of HF Assessment

The required level of HF assessment is determined by combining the highest level of consequence severity from Step 2, with the task type from Step 3. These two elements indicate whether a task requires detailed, generic/moderate, or no further HF assessment. The Task Screening Matrix in Figure 2 supports this decision. Table 2 summarises the three levels of HF assessment and the general intent for each level.

Table 2: Required levels of HF assessment.

Required level of HF assessment	Description
Detailed HF assessment	Required for tasks with significant consequences, or moderate consequences that are also ‘demanding’. This typically involves detailed task and error analysis, such as human failures identification.
Moderate/Generic HF assessment of Performance Shaping Factors (PSFs)	Required for ‘standard’ tasks with moderate consequences, or ‘demanding’ tasks with low consequences. The assessment should assess PSFs of a task in detail. The HF specialist may also determine, based on task characteristics, that other forms of HF assessment are required, for example: anthropometric assessment; workload assessment; link analysis.
No further HF assessment (beyond the screening process)	Used for standard tasks with low or no consequences. The task screening outcome itself provides an adequate level of HF consideration, though justification should be recorded.

The examples listed in the table are indicative only. The specific HF assessments applied at each level will depend on the project, and agreement with the client may be required. For example, in the nuclear construction project where this methodology was first applied, the client required human failure identification as a component of detailed HF assessment. Other projects may specify different approaches, depending on regulatory or organisational requirements.

Step 5 – Document all identified task factors

All information gathered during the task screening process, such as task characteristics, consequences, and HF assessment outcomes are recorded in a screening log. This supports traceability and ensures that HF assessments are proportionate and justified. For each task, the log should capture:

- Task information, such as an identification number and description.
- All identified task error consequences including the severity ratings.
- All identified task characteristics.
- The outcomes of task screening, including:
    - Resulting task type based on task characteristics.
    - Required level of HF assessment.
- Any relevant supporting information, such as stakeholder input, assumptions, or rationale where judgement was applied.

Discussion

Application and benefits observed in practice

The methodology has been applied in nuclear construction projects, where HF specialists noted that it supported early scoping of HF activities and helped ensure proportionality in later HF analysis. Screening was incorporated directly into the task analysis, which improved traceability and ensured that all tasks were considered consistently. Applying the method at level-2 tasks provided the most appropriate balance of detail, as level-1 goals were too broad, and level-3 sub-tasks risked inconsistent treatment. This supported focused HF effort by filtering out tasks with no further HF requirements, and concentrating analysis on tasks screened as needing generic or detailed HF assessment.

HF assessors found the method simple and efficient to use. Once applied a few times, the guidance was rarely needed, and consistency across assessors was achieved through early working sessions and collaborative application. Stakeholder engagement, including discussions with end users, SMEs and the nuclear safety team, was essential for validating assumptions and consequence ratings, particularly when task information was incomplete. Data for screening was drawn from a wide range of sources, including end user workshop (e.g. 'Day in The Life Of') activities, LfE, HAZOPs, and task analysis.

Limitations

Several limitations became apparent during practical application. HF specialists noted that the task-characteristics checklist could be overly prescriptive, particularly where a single criterion flagged a task as 'demanding'. This highlighted the importance of applying professional judgement and approaching the checklist as guidance rather than a prescriptive rule. Some characteristics, such as those relating to 'task novelty', were difficult to assess when information, such as proof in service or incident data, was unavailable. In those cases, items were recorded as 'to be confirmed' and revisited when project information was available. Information gaps also reflected the limited detail available in early project phases, suggesting that some task characteristics may be better assessed later in the design lifecycle.

Another limitation noted during application is that, when the methodology identifies a task as requiring further assessment, it does not specify which HF techniques should be employed. However, the methodology intentionally identifies only the level of HF assessment (detailed, generic or none) and provides examples; the choice of specific techniques is project-dependent and usually addressed through a HF Integration Plan, allowing the approach to be adapted across different contexts.

Finally, the equal weighting of consequence categories may not always align with how different projects prioritise risk, indicating an opportunity to refine consequence weighting in future applications.

Future Development

Future refinement of the methodology could focus on how task characteristics and error consequences are applied across different project contexts. Experience has shown that some characteristics (such as aspects of task novelty) are difficult to assess when information is limited and may be better applied later in the design lifecycle when more information is available. Clarifying when certain characteristics should be used, and providing additional guidance on interpreting qualitative judgements, could improve consistency across assessors. It may also be of benefit to explore whether equal weighting of consequence categories remains appropriate in all settings, as some projects may place greater emphasis on particular types of consequence.

As the methodology continues to be applied, further development may focus on enhancing its adaptability across different industries and organisational environments. While originally applied within nuclear construction, its emphasis on proportionality, consistent judgement, and early integration of HF makes it applicable for broader use. Future iterations could consider how the methodology can be tailored without losing its simplicity, and how LfE gained through wider application can continue to strengthen the approach.

References

Office for Nuclear Regulation (2014). Safety Assessment Principles for Nuclear Facilities (Issue 1, Document No. 2019/367414).