REGULATORY OBSERVATION Resolution Plan	
RO Unique No.:	RO-UKHPR1000-0011
RO Title:	Human Factors capability and integration to deliver the GDA of UK HPR1000
Technical Area(s)	Human Factors
Revision:	Rev 0
Overall RO Closure Date (Planned):	31/12/2020
Linked RQ(s)	NA
Linked RO(s)	NA
Related Technical Area(s)	NA
Other Related Documentation	NA
Scope of Work	

Background

ONR's guidance (Safety Assessment Principles (SAPs)) requires that "*A systematic approach to integrating human factors within the design, assessment and management of systems and processes should be applied throughout the facility's lifecycle*".

Further ONR expectations in relation to Human Factors Integration are set out in TAG NS-TAST-GD-058 of specific relevance are the expectations that:

- HFI requires that HF is an integral part of a project, and is not carried out in isolation.
- The level of HFI should be align with the size of the project, and take account of the safety reliance on humans and the consequences of human error, together with the novelty and complexity of any new technology.

The UK HPR1000 PCSR – Chapter 15 Human Factors Claims (Claim 3.3.8.1) that a "*Comprehensive programme of HF activities are used to integrate HF into the entire design process of the UK HPR1000.*" To deliver such a claim, ONR consider it necessary for a suitable and sufficient Human Factors (HF) capability to exist within the Requesting Party (RP), including their supporting organisations. A vital aspect of this capability is for the RP to be able to demonstrate how ONR expectations regarding integration of HF into the design are likely to be met. Of particular importance during GDA is the expectation that the design process used to develop the UK HPR1000 design integrates suitable and sufficient HF requirements to show that associated risks are reduced to As Low As

Reasonably Practicable (ALARP).

Whilst ONR acknowledges the significant progress made by GNS/GCN to date in meeting ONR's regulatory expectations for developing its HF capability, ONR does not consider the current capability available to deliver the UK HPR1000 GDA project to be adequate. In particular, there does not appear to be suitable and sufficient capability to deliver the Human Factors Integration (HFI) programme set out in the PCSR and Human Factors Integration Plan (HFIP) submitted, including accommodating likely additional emergent work.

ONR has also observed that under the current HFI arrangements, CGN engineering disciplines, which should be drawing upon their in-house HF capability and actively requesting support, are not effectively doing so. This approach fails to meet ONR expectations and relevant good practice where HF is integrated into the wider design arrangements.

ONR therefore issued RO-UKHPR1000-0011 to make ONR expectations clear. This resolution plan is provided as a response to ONR's expectations.

Scope of work

An updated HFIP will be produced along with periodic reporting of metrics from the KPIs in response to RO-UKHPR1000-0011. This will demonstrate that CGN have identified the full scope of Human Factors work to be completed during GDA and that sufficient capability is available to support its HF scope of work. The reports will also show CGN's design processes ensure that adequate HFI is an outcome of these processes rather than a stand-alone HF driven activity.

This Resolution Plan describes the scope and intent of the reports to be produced in response to each of the Actions and provides the schedule for their delivery.

Deliverable Description

RO-UKHPR1000-0011. A1 - Demonstration of the adequacy of Human Factors capability and integration

In response to this Regulatory Observation Action, GNS/CGN will review and update the Human Factors Integration Plan (HFIP) to report progress and to set out plans for step 4. This will be achieved by updating the HFIP and monitoring HFI progress. The programme for this work is detailed in Appendix A. The planned activities are described further below:

1. Update the Human Factors Integration Plan to Rev. E

Human Factors Integration Plan (HFIP) need to be updated to answer the queries in this RO on the following aspects:

Key Performance Indicators

KPIs are being developed for the implementation of HF in the UK HPR 1000 GDA project in three groups. These are summarised below.

- Group 1 Percentage of work scope completion

- Group 2 HF Resource
  - Number of posts in the organisation filled
  - Number of external contractors engaged against target
  - Number of HF staff attended prescribed training
  - Number of non HF SQEP attended HF training
  - Number of non-HF SQEP staff undergoing mentoring

- Group 3 HF Integration
  - Number of HF issues raised by HF team
  - Number of HF issues satisfactorily addressed
  - Number of HF issues raised by Non HF team staff
  - Number of HF issues satisfactorily addressed
  - Number of requests for HF support from other engineering disciplines
  - Number of requests for HF information from other engineering disciplines
  - Number of invites to multi-disciplinary forums
  - Number of RQ/RO support from other area
  - Number of HFE team joined other area L4 meeting

These will be descibed in the Human Factors Integration Plan (HFIP).

Human Factors GDA Progression

This section describes the planned outcomes for HF in GDA and therefore sets the scene for the work scope.

There are four main workstreams in GDA:

- Work stream 1: HF integration into Systems, Structures and Components (SSCs) design, including HFE guideline development and implementation, HF design review
- Work stream 2: HBSC substantiation
- Work stream 3: Function Allocation assessment
- Work stream 4: This will complement workstreams 1 to 3, and provide the design maturity description,which used as baseline or assumptions for HF assessment.

For each work stream, the HFIP describes the planned endpoint in the GDA. This can be summarised as:

- Completion of appropriate HF review of high risk and complex areas and systems
- HBSC identified
- The risk significance of the HBSC identified and risk ranked. Those high risk significant HBSCs be assessed
- Function allocation assessment completed
- A list of assumptions produced
- All identified issues be recorded and sentenced on an ALARP basis
- A programme of required HF work for licencing stage will have been drafted.

Resource

As part of the HFIP update work the organisational structure and resource levels of the CGN and GNS Human Factors team is reviewed. Two kinds of solutions to the current shortfall in resource need to be discussed and detailed in the HFIP.

The overall issue will be resolved using the following two methods:

CGN Resource

CGN has increased the size of HFE organisation size by two means:

a) Established a multi-disciplinary HF team, by setting up a group containing team members from other disciplines such as PSA, Fault Schedule, Mechanical design, I&C, etc.
b) Recruited and employed six suitable people to lead HF activities: one of them having the experience of a senior reactor operator, two with operating experience, two with commissioning experience and one with a detailed knowlegde of human reliability analysis.

Engagement of UK Suppliers

CGN have currently engaged CRA and Wood to improve the SQEP resource available to the project. Following the reciept of this RO discussions were held with CGN management in order to make the procurement of UK suppliers more efficient.

Capability

In the HF area, role profiles have been developed. The team has been reviewed against the role profiles. This review has been used to identify the need for further training, mentoring or areas where external resource is needed. For each role profile the number of staff that partially meet each role need to be summarised in the HFIP.

The training plan need to be updated to keep compliance with the requirements of the roles. This is described further in the next section.

Human Factors Team Training

Training has been delivered to the HF team and other disciplines. It is recognised that further training is required and this will be further detailed as the project goes on. This section summarises the planned training in advance of the completion of the training plan.

Training and skills development is ongoing in both Human Reliability and Design Review. CGN have experience using ASEP, THERP and SPAR-H. The UK context is to base the HRA on task and error analysis as well as the deterministic rules found in the ONR SAPs. Training was provided to the HF team in March 2018 that covered these areas. This has been supplemented by the CGN HF team working with ENGL on a number of HBSC assessments after the training. These have given the CGN staff the opportunity to practice the skills learnt in training. This approach is continuing with support from other external experts.

The CGN HF team have experience in the design of computerised Human Machine Interfaces, conventional panels and control rooms. The UK context requires formal reviews of the design of important systems. It has been recognised that training is required for such reviews. A training course is delivered in December 2019.

The learning objectives are as follows.

- Recall the principle requirements for design substantiation considering:
  - Constructability
  - Operability
  - Maintenance
  - Decommissioning
- Identify and locate key UK context documents
- Carry out a review of a user interface
  - make judgements of adequacy
  - justify and record those judgements
  - make recommendations for improvements
- identify the benefits of those recommendations

Human Factors Training of Other Disciplines

All dsicplines have attended a HF breifing session but it is recognised that further support is required. It is planned to develop HF engineering guidelines in the following areas.

- Architecture Design
- Mechanical Equipment Design
- Electrical Equipment Design
- Communication Equipment Design
- HVAC Equipment Design
- I&C Equipment Design

New training courses will be developed and run in 2020. These will use some of the content of the training given to the HF team and introduce the new HFE guidelines. The courses will not only provide information to allow engineers to identify HF issues but also improve HF integration in the project.

The CGN HF team will provide ongoing support to the engineers and will act as mentors to the engineering discipline representatives.

Design Process

The design process need to be described in HFIP and it shows how HF is integrated into SSC design and safety case analysis.

1) Quality Assurance Process

The deliverables which require a detailed technical check by UK HF experts will be identified in order to ensure all HF deliverables are produced to the highest possible standard. All deliverables will also be reviewed by the GNS HF team in order to ensure all documents meet the required quality. This list of deliverables will also be listed in the HFIP.

2. HF integration monitoring during Trial Period

Following the production of the updated revision of the HFIP a 4 month trial period is implemented at the end of step 3 and start of step 4. There is a monthly review of HFI KPIs with initiatives put in place such as HF awareness messaging, being targeted at areas where little HF integration is being witnessed. Also, this is reviewed in a workshop with UK HF experts at the end of the trial period in order to identify any missed KPIs and any good and bad practice undertaken during the trail period during updating HFIP to Rev.F.

3. Produce Human Factors Integration Plan Rev F

This is produced in a similar manner to the HFIP discussed in Section 1 but also need to document and discuss the trial period and highlight any lessons learned and improvements need in order to meet the required standard for the end of GDA.

In addition, the SQEPness of CGN, in terms of the Human Factors knowledge,is to be re-evaluated to assess the results of the training conducted previously and to adjust the training plan consequently.

Closure of RO-0011

The evidence to close this RO will be the improvement in the quality of HF deliverables during Step 4, which will be presented in a summary report of HF Progress with the commitments made in this RO and the tracking of the KPIs committed to in the HFIP.

Impact on the GDA Submissions

The information will be incorporated into PCSR Chapter 15 v2 submitted in the following GDA Steps. Related PCSR chapters and their supporting submissions are also involved in this resolution plan.

GDA Submission Document	Related ROAs	Planned schedule for submission
Human Factors Integration Plan Rev E		15th November 2019
Human Factors Integration Plan Rev F		30th March 2020
Human Factors Integration Summary Report		30th October 2020

Timetable and Milestone Programme Leading to the Deliverables

See attach Gantt chart in Appendix A.

Reference

APPENDIX A RO-UKHPR1000-0011 Gantt Chart

Task and Schedule	2019			2020												2021	
	30-Sep	30-Nov	31-Dec	31-Jan	29-Feb	31-Mar	30-Apr	31-May	30-Jun	31-Jul	31-Aug	30-Sep	31-Oct	30-Nov	31-Dec	31-Jan	28-Feb
RO Action 1																	
Development of deliverable-[Human Factors Integration Plan Rev E]																	
Submission of deliverable-[Human Factors Integration Plan Rev E]																	
Development of deliverable-[Human Factors Integration Plan Rev F]																	
Submission of deliverable-[Human Factors Integration Plan Rev F]																	
Development of deliverable-[Human Factors Integration Summary Report]																	
Submission of deliverable-[Human Factors Integration Summary Report]																	
Assessment																	
Regulatory Assessment																	
Target RO Close Date																	