DEP SPECIFICATION

HUMAN FACTORS ENGINEERING IN PROJECTS

DEP 30.00.60.10-Gen.

February 2011

DESIGN AND ENGINEERING PRACTICE

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of Shell Global Solutions International B.V. (Shell GSI) and, in some cases, of other Shell Companies.

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APPENDICES

1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements for the application of Human Factors Engineering (HFE) in capital projects.

This is a revision of the DEP of the same number dated May 2007; see (1.7) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied for other similar facilities.

When DEPs are applied, a Management of Change (MOC) process should be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regard to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

term	definition
ALARP	As Low As Reasonably Practicable. As defined in HSSE & SP CF Glossary - the point at which the cost (in time, money and effort) of further risk reduction is grossly disproportionate to the risk reduction achieved.
CF	Shell Group HSSE Control Framework
HEMP	Hazards and Effects Management Process
HFE Technical Authority	The individual assigned as Technical Authority for HFE on the project in compliance with Business Unit and Group standards.
Human Factors Engineering	A multidisciplinary science that focuses on the interaction between the human and the work system in order to design human-machine interactions that optimise human and system performance. [ISO 6385]
HFE Implementation Plan	Plan that defines the programme of work required to be conducted during the project Execute Phase.
HFE Strategy	Strategy for incorporating HFE into project activities, including actions defining the programme of work to be conducted during DEFINE phase of a capital project. The strategy should be derived from the HFE Screening performed during SELECT or early in DEFINE.
HFE Working Group	Comprising at least OPS/Maintenance representatives, Project Manager or delegate, Process Engineer/Integrator and HFE Coordinator. Depending on the specific scope, the team could be expanded to include relevant Shell and Contractor(s) engineering disciplines.
Critical Task Inventory	An inventory of human tasks, identified by application of DEP 30.00.60.19-Gen., that are considered to be critical to asset integrity or process safety.
Ops	Operations
ORM	Shell Group Opportunity Realisation Manual.

1.4 ABBREVIATIONS

EPC	Engineering, Procurement and Construction
HFE	Human Factors Engineering
HFEIP	Human Factors Engineering Implementation Plan
HFE Plan	Human Factors Engineering Plan (deliverable by EPC contractors)
HFEWG	Human Factors Engineering Working Group
HSSE & SP	Health, Security, Safety, Environment and Social Performance
ORM	Opportunity Realisation Manual
TA	Technical Authority

1.5 CROSS REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced by this DEP are listed in (7).

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the Administrator at standards@shell.com, using the DEP Feedback Form. The DEP Feedback Form can be found on the main page of "DEPs on the Web", available through the Global Technical Standards web portal http://sww.shell.com/standards and on the main page of the DEPs DVD-ROM.

1.7 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated May 2007.

Content of the previous version that was background information, explanation and guidance, and therefore not required to be communicated to the Contractor, has been removed.

This revision also:

1. Aligns with changes in the Group Standard for HSSE and Social Performance and the introduction of the HSSE & SP Control Framework.
2. Aligns with the Shell Group Manual of Authorities and the Technical Authority framework introduced by the Discipline Control and Assurance Framework (DCAF)
3. Reflects experience and feedback from application of HFE on projects since 2007.
4. Allows for customisation of the way HFE is implemented on projects based on assessment of the complexity of the project, rather than simply on capital size.

This revision also aligns with recent updates to other DEPs in the HFE series (30.00.60.xx).

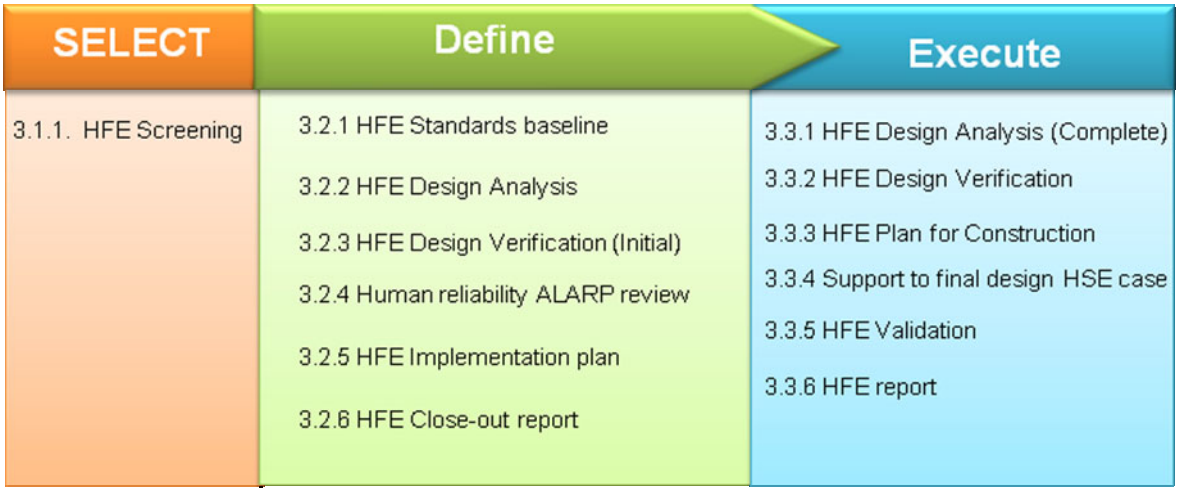
2 APPLICATION OF HFE

Shell projects shall apply the principles of Human Factors Engineering during the design and execution stage of projects.

3 HFE PROCESS

HFE shall be initiated in the SELECT phase of projects. Figure 1 summarises the HFE Activities required to be conducted in each of the SELECT, DEFINE and EXECUTE phase of the project lifecycle.

Figure 1 Summary HFE Activities by project lifecycle phase



3.1 SELECT PHASE

3.1.1 HFE Screening

An HFE Screening shall be conducted. The screening should normally be conducted in SELECT phase, unless the HFE TA and Project Manager agree there are grounds to delay the screening until the start of DEFINE phase.

- The Project Manager, or delegate, shall contact the relevant HFE TA during project SELECT phase to agree how and when the screening is to be conducted.
- The HFE TA shall advise on the scope and method to perform the screening as well as required participants, taking account of the size, scope and complexity of the project.
- The project manager, or delegate, shall arrange for HFE resources.
- The HFE Screening shall determine which other HFE DEPs in the 30.00.60.XX-Gen. series shall be applied to the project.

The output of the HFE Screening shall be either:

- A minuted record that there is no value to be added by applying HFE to the project,

OR

- An HFE Strategy for the project.

3.2 DEFINE PHASE

3.2.1 HFE Awareness

The project HFE Technical Authority, or nominated HFE Specialist, should deliver awareness training to ensure the project team are sufficiently aware of the project's HFE standards, requirements, work programme and quality control activities.

3.2.2 HFE Standards Baseline

The project standards baseline shall be reviewed to ensure it includes appropriate technical standards covering the HFE work scope as identified in the HFE Strategy. If necessary additional Standards shall be identified and included in the project standards baseline.

3.2.3 HFE Design Analysis (Initial)

HFE design analysis activities identified in the project HFE Strategy to be conducted during DEFINE phase shall be completed. HFE requirements identified through the HFE design analysis shall be incorporated into the relevant project documentation (Project Specifications, Procurement Specifications, etc).

3.2.4 HFE Design Verification (Initial)

The design shall be reviewed to ensure HFE requirements are being met to the extent that the design is developed during DEFINE phase.

3.2.5 Human Reliability ALARP review

For projects where DEP 30.00.60.19-Gen. is included in the project base-line, tasks included in the Critical Task Inventory shall be reviewed to ensure the design has incorporated features identified as being necessary to reduce risk of human unreliability to ALARP.

The output of the review shall be a record of the current ALARP judgement for those tasks included in the Critical Task Inventory, and an action plan to ensure any work needed to further reduce the risk, or to be able to support the ALARP judgement, is included in the HEMP (or HFE) plan for EXECUTE phase.

3.2.6 HFE Implementation Plan for EXECUTE

For projects conducted under the Opportunity Realisation Manual (ORM), an HFE Implementation Plan (HFEIP) shall be produced, specifying the HFE quality control activities to be conducted during EXECUTE phase and the roles, responsibilities and reporting, including those of the EPC Contractor and vendors, that shall be put in place.

The HFEIP shall define whether the project HFE Working Group is required to meet during EXECUTE phase and whether additional HFE design analysis and/or HFE Verification activities need to be conducted.

The HFEIP shall be included in the project schedule and/or the bid package for EXECUTE phase engineering contractors.

3.2.7 HFE DEFINE Close-Out

At the end of DEFINE phase, the project HFE Coordinator shall:

- Ensure all HFE Actions have either been completed or closed, or are included in the HFE Implementation Plan for EXECUTE phase.
- Review key HFE risks and ensure those of sufficient impact are included in the project risk register.
- Review working of the HFEWG (if it has been organised) and identify any changes needed to improve efficiency and impact in EXECUTE phase.

3.3 EXECUTE PHASE

3.3.1 HFE Design Analysis (Complete)

The HFE design analysis activities identified in the project HFE Strategy to be conducted during EXECUTE phase shall be completed.

3.3.2 HFE Design Verification

The design shall be reviewed to verify that the design complies with the project HFE Standards as defined in the project standards baseline (see 4.2.1), and that any HFE requirements identified through HFE Design Analysis conducted in DEFINE and EXECUTE phases have been satisfied.

3.3.3 HFE Plan for Construction

Prior to commencement of Construction activities, an HFE Plan for Construction shall be developed complying with DEP 30.00.60.14-Gen.

3.3.4 Human Reliability Review

For projects where DEP 30.00.60.19-Gen. is included in the project base-line, Human error ALARP reviews shall be completed for all tasks included in the Critical Task Inventory which have been added during EXECUTE phase, or where there has been significant change in the task or design since DEFINE phase.

3.3.5 Support to ALARP Demonstration

Relevant considerations of the potential for human failure shall be captured in the ALARP Demonstration either directly, or as a reference to the results of the Human Reliability review. This shall ensure that evidence or action taken to ensure the risks have been reduced to ALARP is documented and traceable.

3.3.6 HFE Validation

HFE shall be included as a subject in the pre-start-up audits. This shall validate that construction of the facility has met the HFE design requirements, or introduced new HFE risks.

3.3.7 HFE Project Close-Out Report

An HFE Project Close-Out report shall be prepared. The report shall cover the following items:

- Initiation: Was an HFE Strategy developed at an appropriate time to have effective input to defining the project standards, technical baseline, and organisational requirements?
- Competence: Did the project have access to adequate resource in terms of HFE competent people, and were steps taken to ensure appropriate awareness among discipline engineers and contractors, including construction contractors.
- Implementation: Did the project effectively implement the agreed HFE Strategy for DEFINE and the HFE Implementation Plan for EXECUTE phase? If an HFEWG was organised, did it operate effectively? Were technical HFE deviations/variances approved by the appropriate HFE TA?
- Results: Did the results of the pre start-up audit, or any other pre-commissioning inspections, indicate that HFE standards and requirements had been complied with in the design and construction?
- Actions: Have all actions raised in the HFEWG, or elsewhere in the HFE programme been completed or closed?
- ALARP Demonstration: Does the ALARP Demonstration include demonstration of the efforts taken to reduce risk of human unreliability to ALARP through engineering and design?
- Remaining Risks: Are there significant HFE risks that have not been reduced to an acceptable level and that may require additional organisational controls?
- Lessons Learned: Are there any issues or learnings arising from the project experience that should be fed back to the global HFE team to improve the HFE Process or Standards?

The HFE Project Close-Out Report shall be approved by the project HFE TA.

4 ORGANISATION AND RESPONSIBILITIES

The HFE organisational arrangements identified in the project HFE Strategy shall be implemented. This shall include ensuring the required HFE competence is available within the project team, as defined in Table 2.

4.1 PROJECT HFE CO-ORDINATOR

An individual shall be appointed to the role of project HFE Co-ordinator (unless the HFE Screening determines that the role is not required due to the lack of HFE complexity in the project). The individual appointed shall have HFE Competence at Knowledge level as defined in section 4.4.

Terms of Reference for the HFE Co-ordinator shall be prepared and agreed with the project HSSE manager based on the recommended example in Appendix 1.

4.2 HFE WORKING GROUP

For projects conducted under the ORM, an HFE Working Group should normally be established appropriate to the size and complexity of the project. For major projects, the HFEWG should be chaired by Shell.

Terms of Reference for the HFE Working Group shall be prepared and agreed with the project HSSE manager based on the recommended example in Appendix 2.

4.3 RESPONSIBILITIES

Responsibilitise for executing and supporting HFE activities shall be allocated to project members as identified on Table 1.

4.4 COMPETENCIES

Table 2 specifies the competence requirements for filling each of the roles required to implement HFE on projects. It also specifies the minimum levels of training and experience required at each competence level.

Table 1 Project HFE responsibilities

	ORM Project (+$100 mln)			Non-ORM Projects (<$100mln)		
Project Phase	Manager	Project HFE Co-ordinator	HFE TA	Manager	Project HFE Co-ordinator	HFE TA
SELECT						
1. Contact HFE TA to define approach to HFE Screening	EXE			EXE		
2. Facilitate HFE Screening	APP		EXE	APP	EXE	CHK
3. Prepare project HFE Strategy	APP		EXE	APP	EXE	CHK
DEFINE						
5. Appoint HFE Co-ordinator	EXE		APP	EXE		
6. Initiate HFE Working Group	APP	EXE	CON	If required, same as for ORM projects.		
6. Manage implementation of HFE Strategy	APP	EXE	CON	APP	EXE	CON
7. Prepare HFEIP for EXECUTE phase	APP	EXE	CON	APP	EXE	CON
8. Close-Out Report (DEFINE)		EXE	APP		EXE	CON
EXECUTE						
9. Manage implementation of HFE IP		EXE	APP		EXE	CON
10. HFE Plan for Construction	APP	EXE	CON	APP	EXE	CON
11. Support pre start-up audits		EXE	CON		EXE	CON
12. HFE Report		EXE	APP		EXE	CON

Key:

EXE = Execute

CON = Consult

CHK = Check and verify results

APP = Approve

SUP = Support

5. REFERENCES

In this DEP, reference is made to the following publications:

NOTES:
1. Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.
2. The DEPs and most referenced external standards are available to Shell staff on the SWW (Shell Wide Web) at http://sww.shell.com/standards/.

SHELL STANDARDS

Human Factors Engineering in Projects – DEP Informative	DEP 30.00.60.10-Gen
Human Factors Engineering - Application during construction	DEP 30.00.60.14-Gen.
Human Factors Engineering – Design for critical tasks	DEP 30.00.60.19-Gen.
HSSE & SP Glossaryof Terms	
RoyalDutch Shell Opportunity Realisation Manual	

Table 2 HFE competence requirements

Project roles	HFE Competence Level	Competencies	Project Activities	Minimum Training requirements	Experience
Project Manager; Project HSSE Manager; Project OR&A Manager Discipline Lead; Discipline Engineer; Member of HFE Working Group.	Awareness (A):	Knowledge of the scope and relevance of HFE to Shell. • Able to describe the HSSE CF mandatory requirements. • Awareness of the existence of Shell HFE DEPs • Able to recognise how and where competence in HFE is relevant to their own job	Awareness of why the project has HFE activity and how it relates to own discipline.	Attended an HFE Awareness course **OR** Completed Awareness level E course training of the Shell Open University (SOU). See SOU website.	Industry experience relevant to main job.
HFE Coordinator	Knowledge (K):	Awareness PLUS 'can do' the following: Able to interpret and evaluate information and advice from HFE TA: • Know and be able to use correctly HFE terminology. • Understand what makes projects complex in terms of HFE. • Understand Shell's HFE governance requirements. • Understand the role and typical organisation of an HFEWG. • Awareness of Shell's HFE Screening tools, and competent to apply the HFE Minor Projects screening tool. • Able to lead simple HFE design analyses. • Awareness of the scope and content of Shell HFE DEPs, other standards and relevant legislation.	• Able to act as project HFE-Co-ordinator. • Able to chair HFE Working Group. • Able to conduct HFE Screening and prepare HFE Strategy for low complexity projects. • Able to facilitate Valve Criticality Analysis. • Able to act as technical point of contact with HFE TA.	Typically 16 hours classroom + 20 hours work experience comprising: • Knowledge level Classroom training through SI-CAH or Shell Open University (SOU). **AND** • Acted as HFE Coordinator on at least one project with supervision by an HFE TA.	Minimum of 2 years experience in new design (Greenfield and/or Brownfield) capital projects.

Table 2 HFE competence requirements (Continued)

Project roles	HFE Competence Level	Competencies	Project Activities	Minimum Training requirements	Experience
HFE Authorised Person	Skilled (S):	Knowledge PLUS 'can do' the following: Being able to consistently carry out HFE activities to the required standard: • Able to perform satisfactorily the majority of HFE activities • Able to translate HFE guidelines and standards into practical actions • Able to solve imaginatively common HFE technical and/or operational problems • Able to guide and advise others on technical and/or operational aspects of HFE.	• Facilitate HFE Screening for most ORM projects that are not Top 70. • Facilitate HFE Design Analysis • Represent HFE in Reviews and technical meetings. • Can act as HFE TA for ORM projects that are not Top 70 and do not have significant process safety risks (RAM 4 or 5).	Either A OR (B1 and B2) A: Equivalent to Certified Ergonomics Associate (CEA) of the USA Board of Certification in Professional Ergonomics.	3 years relevant industry experience.
				B1: At least 3 years experience as HFE Co-ordinator or leading HFE on projects including application of Shell or industry HFE Standards. AND B2: Assessed by Shell HFE Global Discipline Lead as having sufficient technical knowledge and being capable of producing quality HFE deliverables.	10 years oil and gas industry experience (e.g. operations, Engineering, HSE, Technical Safety).

Table 2 HFE competence requirements (Continued)

Project roles	HFE Competence Level	Competencies	Project Activities	Minimum Training requirements	Experience
HFE Authorised SME	Skilled (S):	As for HFE Authiorised Person	As for HFE Authorised Person PLUS • Can be appointed as project HFE TA on any project.	Satisfies professional certification requirements of recognised professional bodies, such as: • Centre for Registration of European Ergonomists (CREE) • Institute of Ergonomics and Human Factors (IEHF) • USA Board of Certification in Professional Ergonomics (CPE/ CHFP) • Canadian Certification Council for Professional Ergonomists (CCCPE) • Register of Professional Certified Ergonomists (Australia) • Board for Certification of New Zealand Ergonomists (BCNZE) • JES Certification Program for Professional Ergonomists (Japan)	At least 10 years relevant professional experience, including at least 5 years oil and gas industry experience.
Any	Mastery (M):	Skill PLUS 'can do' the following: Being able to diagnose and resolve significant, unusual problems and to successfully adapt aspects of HFE • Able to solve significant, complex, non-routine HFE problems • Able to adapt HFE practices from other markets or countries • Able to generate substantial improvements to local HFE practices and procedures.	Advisor	As Authorised SME	20 years relevant professional experience including at least 7 in oil and gas industry.

APPENDIX 1 TERMS OF REFERENCE FOR PROJECT HFE CO-ORDINATOR (For ORM project)

Role	The role of the HFE Co-ordinator is to act as a manager and focal point for Human Factors Engineering (HFE) on a project.
Initiation	The role of the HFE Co-ordinator should be initiated following the project HFE Screening, where it is identified that an organised programme of HFE activity is required. The role should therefore normally be initiated early in DEFINE phase, once the project HFE Strategy and Action Plan has been approved.
Responsibilities	• Liaise with the project HFE TA. • Ensure individuals on the project who have responsibility for conducting or supporting HFE activities, have the appropriate level of HFE competence (as defined in Section 4, Table 2 of DEP 30.00.60.10-Gen.). • Ensure contractors comply with the HFE requirements defined both in their work programme, and within the project technical specifications. • Ensure effective communication and liaison between the HFE project team and other activities in the project HSE and engineering programme. • Manage the resolution of conflicts between HFE and other technical and commercial requirements. • Maintain a register of HFE risks, issues and actions, and ensure risks rated as RAM red risks or yellow 5B risks, or as determined by HEMP activities to require tracking in the register are entered into the overall project HSSE risk register and tracked until completion. • Organise and report on activities of the project HFE Working Group. • Act as deputy chair of the HFE WG (to substitute for Project Manager or their representative). • Manage delivery of the project HFE Implementation Plan for EXECUTE phase. • Ensure project HFE deliverables are subject to appropriate technical review and other QA requirements.
Reporting	The HFE Co-ordinator should report directly to the Operations Manager for the business sponsoring the project.
Interfaces	• Project HSSE Manager • Directly with regional HFE Authorised SME/HFE TA for technical support as required. • OR&A Manager; • Commissioning and start-up team • HEMP Leader • With other project disciplines via the project HFE Working Group.
Competence requirements	• At least Knowledge Level competence in HFE.

APPENDIX 2 TERMS OF REFERENCE FOR AN HFE WORKING GROUP (HFEWG)

This appendix includes an example of the Terms of Reference for an HFEWG. An HFEWG will usually be formed for projects assessed as being complex in HFE terms.

This example reflects what is known to have workled well on previous projects. However, there will always be project-specific factors (geographically dispersed project teams, parternship arrangements, contracting arrangements, country-specific requirements, etc) that will require special consideration. New projects should customise these ToRs to suit what will work best in their particular context.

1. Purposes and Scope

The HFEWG provides the formal project forum for discussion and resolution of issues associated with the HFE work programme. It shall maintain oversight and ensure progress on technical issues associated with implementation of HFE design requirements.

The HFEWG shall oversee implementation of the project HFE Strategy and provide a forum to resolve cross-disciplinary issues and facilitate integration of HFE across the project.

2. Core Attendees Roles and Responsibilities

Additional personnel may be invited to attend specific meetings to help address any specific issues that have been identified by the HFEWG.

Role	Responsibility	Name and Contact Details
Project HFE Chair	Chair the HFEWG meetings and highlight critical issues with other members of the project management team to ensure necessary support for follow up. The Chair is a member of the project HSE Management team.	
HFE Coordinator	Coordination of HFE activities and delivery of the HFE work scope.	
HFE TA	Quality Assurance and Quality Control of the HFE CTR deliverables.	
Discipline Engineers	Facilitate integration of HFE with relevant disciplines.	

3. Meeting Duration and Frequency

Two hour meeting on a 2 weekly basis for the first 3 meetings. Subsequent meetings as required, but expected to be held on at least a monthly basis.

Where possible, HFEWG meetings should be scheduled shortly before the monthly HSE meeting. This will enable xxx (HFEWG Chair) to highlight relevant HFE issues at the HSE meeting.

4. Standing Agenda

1. Minutes of previous HFEWG
2. Actions Arising
3. Progress against HFE Work Plan
4. Progress against Deliverables
   - 4.1 Deliverables developed since last meeting
   - 4.2 Deliverables expected before next meeting
5. HFE Interfaces with other disciplines

6. Review of key HFE Risks
7. AOCB

5. Minutes of Meeting (MoM) Distribution List

List of roles who should receive copies of the HFEWG meeting minutes.