NORSOK Standard

Standards Norway
Strandveien 18, P.O. Box 242
N-1326 Lysaker
NORWAY

Telephone: + 47 67 83 86 00
Fax: + 47 67 83 86 01
Email: petroleum@standard.no
Website: www.standard.no/petroleum

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Table of Contents

List of Tables

ANNEX A (Normative) GENERAL WORKING ENVIRONMENT ACTIVITIES

ANNEX A (Normative)

GENERAL WORKING ENVIRONMENT ACTIVITIES

A 1 Introduction

Annex A describes the normative WE/HF activities to be performed during a project development as given in table. 5.1.

A 2 General activities and analysis

A.2.1 Project Screening of Working Environment and Human Factor Activities

A.2.1.1 Purpose

To establish which Working Environment and Human Factors analyses and activities that shall be performed during the project, to which level of detail.

A.2.1.2 Description

Screening shall first take place in the Concept Phase, and thereafter prior to the start of subsequent project phases. This is to allow time for appropriate resource allocation in each project phase.

For brownfield projects, identification of existing studies shall be performed. The WE and HF impact of changes to the existing installation shall be evaluated by use of a checklist (see Annex F for example). Analyses to be updated or performed shall be identified. Justification for decisions shall be documented.

For greenfield projects, performance of the first screening should be at a coarse level according to areas of the installation. The screening analysis shall involve the use of a checklist (see Annex F for example). Analyses to be performed shall be identified. Justification for decisions shall be documented.

Performance of the screening activity shall involve relevant personnel, with a minimum of representation from Operations, HF discipline and WE discipline.

A.2.1.3 Input

- Concept description
- Applicable regulations and standards
- Existing analyses/study reports (brownfield project)
- Operation and maintenance philosophy
- Experience transfer from similar projects and operations

A.2.1.4 Deliverables

WE & HF screening report defining studies and activities related to relevant project phase. Report to be updated for each project phase.

A.2.2 Experience transfer

A.2.2.1 Experience transfer workshop

A.2.2.2 Purpose

Ensuring transfer of experience from relevant installations in operation or under construction. A further purpose is to ensure that problems and success factors in similar projects are identified. The experience report shall be used to identify installation areas and vendor packages that need particular attention during design development, and to develop adequate requirements. End-user involvement is important.

A.2.2.3 Description

Typically an experience transfer report will include a workshop including participants from different disciplines with operation experience from relevant concepts (projects??? PK). Additionally, working environment specialists should be included.

A.2.2.4 Input to activity

1.
    1. Requirements (national and company requirements and standards)
    2. Input from similar projects
    3. Previous modifications done to improve WE
    4. Solutions / equipment to be avoided
    5. Solutions / equipment to be preferred
    6. BAT: Best available Technology / Technique
    7. Statistics on occupational accidents and injuries, near-accidents and work-related diseases
    8. Results of WE surveys and risk assessments

A.2.2.5 Deliverable

An experience transfer report including good and bad solutions. The content of the experience transfer report will depend on the project phase and also on the complexity of the working environment risks at each individual plant/project/organisation. The report can be updated as the project develops.

A.2.2.6 Situational analysis in Brownfield projects (assessment of the current WE condition).10.06.201410.06.2014 16:11S-002 Rev 2:March 6 2014Annex C Human Factors ActivitiesInsert EN/ISO UtgivelseInsert EN/ISO-NummerInsert Engelsk tittel - OmslagssideInsert Evt. Engelsk tittelInsert ICS kodeInsert Norsk tittelInsert Norsk tittel - Omslagsside2014Insert NS Utgivelse [NS month and year]Insert NS-NummerInsert Standarden erstatterInsert Rev No.

This chapter must be revised. Is the structure of this sensible? Would not Level 2 be right for this Situational Analysis, parallel to A 2.2 Experience transfer, i.e., A2.3 Situational Analysis? I think A2.2.1 can be removed in this case.

A.2.2.7 Purpose

Assessment of the current WE condition is the starting point for ~~**Brownfield**~~ **NORSOK** projects. The primary goal is to provide the Asset owner with the necessary information in order to make an informed judgement about the potential modification scope with regard to Working environment and Human Factors issues. Secondary goals are to provide a basis for further Working Environment, Human Factors, and other discipline activities, verify/assess the existing solution against current requirements, communicate the current situation on the facility and contribute to the modification scope and plan.

A.2.2.8 Description

These issues should be covered in the analysis: Steering Documentation, Work Organisation, Training, Procedures, Workplace Design, Physical WE factors including Noise, Lighting, Chemicals, Arrangement, Interface Design. Data can be collected from a number of complementary sources, including – but not limited to, on site visits/surveys, interviews, inspections, recording measurements, design basis documentation reviews, incident/accident report reviews, current solution reviews against checklists (e. g. CRIOP and or EMMUA). Findings are assessed against requirements and deviations noted. Identification and mitigation of deviations are proposed included in the project modification scope.

A.2.2.9 Deliverables

A report assessing the current situation. The report would typically include results (descriptions, photographs, measurements) from an on-site survey. The report should conclude with deviations, and, where possible, solutions for mitigation / improvement in the modification project. The findings should preferable include a risk assessment.

A.2.3 Working Environment Input to the Design Basis

A.2.3.1 Purpose

1.
    1. Identify relevant national and company specific requirements
    2. Input to general project strategy
    3. Input to other WE studies

A.2.3.2 Description

During early phases of project development, functional and specific WE requirements in regulations, company specifications and applicable standards and codes shall be identified as relevant basis for engineering. Reference is made to the WE design requirements in chapter 6.

WE analyses (Annex A, B, C and D) shall be performed to identify basic actions necessary for fulfillment of the WE requirements. An important part of this is to develop specific/prescriptive, practical design requirements from functional/goal-oriented requirements.

A.2.3.3 Input

1.
    1. Requirements (national and company requirements and standards)
    2. Project Screening
    3. Situation analysis
    4. Manning and Organisation study
    5. Experience transfer workshop
    6. WEAL

A.2.3.4 Deliverables

Document describing WE / HF design basis for the project

A.2.4 Input to technology evaluation including BAT

A.2.4.1 Purpose

Input to technology plan in order to reduce WE and HF risks.

A.2.4.2 Description

This systematic evaluation is to be first performed in Concept phase with a focus on large packages. As the project develops, BAT evaluations shall focus on smaller packages. The need for updating earlier BAT evaluations shall be considered in order to take into account recent technology advances.

Evaluation criteria shall be agreed and prioritised prior to the performance of the evaluation. Pros and cons for each chosen alternative shall be listed. Justification for decisions to be documented.

WE and HF disciplines shall give input regarding WE and HF issues to the party responsible for performing the BAT evaluation.

A.2.4.3 Input to activity

- Requirements (national and company requirements and standards)
- Experience transfer report from similar projects
- GA drawings

A.2.4.4 Deliverable

Input to technology evaluation report(s) documenting BAT.

A.2.5 WE Program

A.2.5.1 Purpose

Define WE objectives and risk acceptance criteria for occupational safety, human error and health risks in the project. Summarize applicable WE requirements and procedures. Describe how to secure worker participation in the design.

A.2.5.2 Description

The program shall implement routines for systematic identification of significant working environment hazards for all relevant working environment factors. Working environment risk management shall represent a systematic, ongoing process within the organisational context so that risks can be monitored and managed effectively. The WE programme shall include an activity plan stipulating the responsibilities, schedule and deliverables for the various WE related activities during the design and construction process.

A.2.5.3 Input to activity

1.
    1. Requirements (national and company requirements and standards)
    2. Experience transfer report from similar projects

A.2.5.4 Deliverable

WE program including a WE activity plan for the project. The report content will depend on project phase. The report can be updated as the project develops. The WE activity plan shall be a live document showing the ongoing status of execution and documentation of the various WE management activities.

A.2.6 Manning and Organisation Study

A.2.6.1 Purpose

To ensure sufficient and competent manning that can handle the various modes of operation, including workload peaks, in a safe and prudent manner. A secondary goal is to provide input data to other safety and working environment studies.

A.2.6.2 Description

The facility operator shall prepare an organisation and manning analysis. The study is to be updated throughout the design process, as more detail becomes available, and when the facility begins operation. The analysis shall include and use information from a wide range of resources - including experience data, as well as analyses of tasks, workloads and other relevant factors. The findings shall generate both manning (numbers) and space requirements (for work, rest and transit). They shall describe the various personnel categories in the organisation (onshore and offshore), their skills and experience, the distribution of their working hours by area, their responsibilities and tasks. Data is required for all modes of operation. The study shall be elaborated in sufficient detail regarding frequency/ duration of tasks to:

- Ensure ergonomic design of workplaces (adequate space for work, rest and transport routes) or ? determine the means of access /egress,
- Show relevant skills and quantity of personnel required for all modes of operation
- Provide input data for psychosocial analyses, determine mental workload, control at work and social interaction. *[Dette forstår jeg rett og slett ikke. Må vises med parallell struktur i leddsetningene. Her vet jeg ikke om de siste tre punktene er en del av psychosocial analyses. PK]*

A.2.6.3 Input to activity

The following activities / reports are suggested as input to the activity:

- WE design basis

- Operation and maintenance philosophy
- Experience transfer reports from similar projects

A.2.6.4 Deliverables

An Organisation and Manning Report that describes personnel requirements and responsibilities in detail, and supports associated analyses of safety and efficiency for all modes of operation. The extent and content of the report will depend on project phase. The report can be updated as the project develops.

A.2.7 Task Analysis

A.2.7.1 Purpose

The aim of task analysis is to identify typical working tasks on the installation, with the purpose of establishing requirements regarding products or technical solutions. It also provides important input to other WE / HF analyses.

A.2.7.2 Description

Task analysis is a systematic review of what employees must do, physically and / or mentally, in order to carry out a task.

A number of different methods may be used to analyse and present the task details (e.g. Kirwan, 1992). The choice of method will be determined by the specific area of application, the nature of the task, the level of criticality and the detail needed to establish design requirements. Findings will also form the foundation for many other analyses and form the basis for the design specifications (e.g. HMI, layout, workplace design, illumination, organisation, noise, vibration, etc.) aimed at optimal performance. Task analysis first takes place at the Concept Select stage and will receive regular updates throughout subsequent phases. Methodology is further described in Annex XXX, section 1.2.

A.2.7.3 Input to Activity

The following activities / reports are suggested as input to the activity:

- GA drawings
- Manning and Organisational Study

A.2.7.4 Deliverable

A task analysis report describing the main work tasks on the installation, with detailed analyses of tasks with greater degrees of interaction and potential for human error and other adverse outcome. The content of the task analysis will depend on project phase and also on the complexity of work tasks and risks at each individual plant / project / organisation. The report can be updated as the project develops.

A.2.8 Working Environment Risk Assessments

A.2.8.1 Working Environment Risk/ Impact Assessment WERA / WEIA

Tror kanskje denne hører med i Level 2, sammen med 2.8.6.

A.2.8.2 Purpose

Identifying potential risks to be followed-up as the project develops, and assessing the impacts of the chosen design solutions. Mitigating actions or requirements ~~should~~ shall be identified to reduce the risk. Issues relating to lay-out and critical long lead items should be identified early in the project development.

A.2.8.3 Description

No activity can be conducted without risk, but the risk can be managed. Risk management shall prioritise and direct available resources to the most relevant measures to control risk.

It is important to communicate the questions connected to risk with a high level of integrity, and to visualise:

- That there are limitations in all assessments and their results, depending on the assumed conditions forming the basis of assessment.
- That any risk based decision is a decision involving uncertainty.

The risk analyses shall be ~~used~~ performed with the intention/desire of identifying the most important contributors to human risks, and selecting the best possible solutions from a health and working environment perspective.

The workshop shall include representatives from the risk owner (project and/or line leader), HWE professionals, technical discipline professionals relevant for the context, and operators familiar with the work tasks and area to be assessed (user group).

A work shop model (such as Hazid) is recommended when performing a WERA. The WERA process shall identify work tasks and health hazards; it shall score (rank?) risks and propose mitigating measures in a prioritized action list based on risk score. The ~~main~~ focus shall be on health risks with short, medium and long latency before consequence.

A.2.8.4 Input to activity

The following activities / reports are suggested as input to the activity:

- Experience transfer from similar projects
- Relevant requirements and standards
- Context / frame conditions
- Previous task analyses
- Manning and organization study (if available)
- Previous WERA reports (if available)
- WEAL report (if available)
- GA drawings

A.2.8.5 Deliverable

The WERA report should include a risk assessment of typical work tasks performed on the installation. The extent and content of the WERA activity will depend on project phase and also on the complexity of the working environment hazards and risks at each individual plant/project/organisation. The identified risks and mitigating measures shall be included in the risk register and followed up through the project. The report can be updated as the project develops.

A.2.8.6 Job hazard

A.2.8.7 Purpose

The aim of a JHA is to identify and evaluate the acute hazards to which employees are exposed when performing work activities, and to establish elimination or control measures that will protect the worker from health risks or injury.

The purpose of a JHA shall not be to evaluate the risk of health hazards due to long term exposure.

Coarse and detailed JHA differ in the level of detail into which the activities are subdivided.

A.2.8.8 Description

Identify dangerous work tasks / interactions associated with the following:

- operation/drilling
- repair/maintenance
- material handling

- waste handling/housekeeping activities
- personnel traffic/walking

These work tasks shall be used as a basis for risk estimation and evaluation.

A step-by-step breakdown of the tasks / activities to a sufficient level of detail shall be carried out and documented in the JHA matrix.

When the tasks are broken down into sub-tasks, these are each evaluated to identify any hazards that might affect the worker(s).

Hazards/hazardous situations and events associated with the various work tasks shall be identified, e.g. risks of severe injury or fatality due to: moving parts of machinery, trapping/entanglement, falling to a lower level, sliding/stumbling/collision, ejected materials, fire/explosion, and/or toxic/corrosive chemicals.

A description of each actual hazard and why a hazardous situation may arise shall be documented in the JHA matrix.

As an aid to identify acute health hazards, the list below may be used ~~as a starting point to get the thought process going in the correct direction~~ for guidance.

Estimation of the occupational accident risks serves as basis for identifying the need for remedial actions, including safety measures and safeguarding in design. The risk assessment is divided into initial risk assessment and residual risk assessment.

In the initial risk estimation, existing design safety measures shall be considered. Additional safety and operational measures (identified during the JHA) are part of the residual risk assessment.

For hazards that can result in occupational injuries, a typical risk matrix (below) with rating criteria for the frequency of occurrence and consequences of hazardous situations shall be used. For each hazardous situation identified, the consequence (‘C’), frequency (’F’), and the resulting risk (’R’) shall be documented in the JHA matrix.

- Firstly, the most serious consequence that, from a realistic point of view, may occur, shall be identified and rated on a scale from 1 to 4.
- Secondly, the expected frequency of the consequence (occurrence? PK) shall be estimated, also on a scale from 1 to 4. Frequency estimations are based on frequency and duration of work or other presence inside the danger zone of the machinery, on the probability of occurrence of the hazardous situation, and on the possibility to avoid or limit the harm.
- Finally, the resulting risk shall be estimated and characterised as High, Medium or Low.

Safety measures shall be identified.

Design safety measures and safeguarding and the residual risk shall be documented in the JHA matrix.

A.2.8.9 Deliverables

A report documenting hazard identification, risk assessment and design solutions for hazard control.

A.2.9 Working Environment Area Limits and Charts

A.2.9.1 Working Environment Area Limits (WEAL)

A.2.9.2 Purpose

Give an overview of all detailed specifications of working environment area limits for each room/work area as input to design development

A.2.9.3 Description

Detailed specifications of working environment area limits for each room/work area that is readily accessible shall be established as input to engineering.

Chapter 6 (+ annex?) stipulates applicable area limits for illumination, airborne chemical contamination, temperature, indoor climate, vibration, total noise levels and HVAC noise levels for typical areas of an installation.

A.2.9.4 Input to activity

1.
    1. All relevant WE and HF requirements for the scope of project
    2. GA drawings

A.2.9.5 Deliverable

Working environment area limits (WEAL) shall be established as input to design development.

A.2.9.6 Working Environment Area Chart (WEAC)

A.2.9.7 Purpose

To document status regarding implementation of WE requirements, WEAC shall be prepared. The WEAC will give basic input to design development and be part of a system to follow-up WE studies and analyses in the project. The WEAC shall be followed up throughout the project.

A.2.9.8 Description

In principle, a working environment area status shall be prepared for each room and area on the installation. However, to maintain a manageable number of area charts, several identical areas (e.g. offices, cabins, escape routes) can be covered by one typical WEAC.

The WEACs shall include the results of predictions and verification measurements (e.g. as-built data for illuminance and noise), and shall describe identified problem areas and nonconformities as well as the status regarding decisions on remedial actions.

Implementation [Fulfilment? PK] of the area limits shall be verified by appropriate measurement methods and documented in the WEACs. This is particularly important in the commissioning and operation phases.

Table 2.1 Working environment area chart to be filled-in as project develops

WORKING ENVIRONMENT AREA CHART Doc. no. Rev. Date Page						
Installation:		Room/area name:		Module/level:	Area no.:	Manning:[a]
WORKING ENVIRONMENT AREA LIMITS						
Factor		Limit/level [b]	Preliminary prediction [c]	Predicted at issue for construction [c]	As built [d]	Status [e] / Notes [f]
Noise:	Total HVAC					
Vibration						
Illumination [j]						
Temperature						
Air changes per hour						

Types of hazardous substances [g]:					
GENERAL					
Factor	Document id. no. [h]	Description of identified hazards/ nonconformities/ comments		Decision	Status [e] / Notes [f]
Arrangements					
Ergonomics					
Human factors					
Technical appliances					
Chemical substances					
Permanent protective equipment					
Outdoor operations					
Radiation					
Notes [f]:					
PREPARED BY [i]:	CHECKED BY [i]:			APPROVED BY [i]:	

Notes:

a Level of manning, see Annex A: Permanently manned (M); Intermittently manned (I); Normally unmanned (U).

b To be established according to XXX.

c Preliminary prediction and prediction at issue for construction shall be made for noise, see XXXX. The need for two separate

predictions shall be evaluated for other factors.

d Measured values during commissioning.

e Status: OK; Action required (AR); Nonconformity, action pending (NCP); Nonconformity, approved (NCA); Not identified (NI);

Not applicable (NA).

f State references to underlying documentation, e.g. nonconformity reports.

g List all identified chemicals, that are planned for use and that may represent a health hazard, see XXXX.

h State document identification number for performed working environment analyses and design reviews.

i May be replaced by signatures on common front sheet.

j Emergency illumination in room/areas with personnel tasks during an emergency situation shall be analysed. For emergency

illumination requirements, see NORSOK S-001 and NORSOK E-001.

A.2.9.9 Input to activity

The following analyses is suggested as input to activity

- GA drawings
- WEAL
- WERA
- Inspection reports
- WEDR

A.2.9.10 Deliverable

Working Environment Area Charts (WEAC) for all areas included in scope of work of project, The WEAC's shall be updated regularly through the project.

A.2.10 Validation and Verification Activities

A.2.10.1 Working Environment Design Review (WEDR)

A.2.10.2 Purpose

The design reviews shall be performed as necessary (i.e. 30 %, 60 % and 90% of development) to verify compliance with specific WE requirements applicable to the contract object.

A.2.10.3 Description

During design development, design reviews shall be performed as necessary to verify compliance with specific WE requirements applicable to the contract object. Special checklists shall be prepared for review purposes and shall be used to document the results

and findings. The design shall be validated to be fit for purpose, according to project technical specirfications and in compliance with all applicable requirements.

In particular, design reviews shall be used for:

- machinery and vendor packages that are considered critical from a WE point of view. For such equipment, suppliers shall be requested to submit the completed checklist as part of the bid documentation, and WE aspects of the delivery shall be evaluated in the bid clarification process,
- installation areas/systems to verify arrangements, material handling and access to equipment. Use of the 3D model is recommended. Reference is also made to the valve and instrument access and operability review
- layout and physical work environment of control centres/CCR,
- installation areas to verify illumination predictions and evaluations.

The WEDR should be done as a workshop with the following participants:

- representatives from the risk owner (project and/or line leader),
- HWE professionals,
- technical disciplines relevant for the context and operators familiar with the work tasks and area to be assessed
- Safety delegate

A.2.10.4 Input to activity

1.
    1. 3D model
    2. General Arrangement drawings
    3. WE input to design basis
    4. WE program
    5. Experience transfer report
    6. Organization and manning report
    7. WEAC/WEAL
    8. Previous WERA reports
    9. Previous WEDR report
2.

Deliverable

Working environment design review documentation shall be produced, either as a separate report or as part of project design review report.

A.2.11 Working Environment Inspections

A.2.11.1 Purpose

During construction and mechanical completion of installation areas/modules and vendor packages, WE inspections shall be carried out to verify that the fabricated contract object is in compliance with established design requirements and that actions from WE analyses are implemented. Fit for use

A.2.11.2 Description

Inspections during construction should take place while rectification work is still possible, e.g. 80 % complete. Special checklists shall be prepared for inspection purposes, and shall be used to document the results and findings.

A.2.11.3 Input to activity

1.
    1. WEAL
    2. WEAC

A.2.11.4 Deliverable

A working environment inspection report including checklist should be delivered.

A.2.12 WE Summary Report

A.2.12.1 Purpose

To secure experience transfer to the next phase or, at the end, to the operation.

A.2.12.2 Description

A WE status report shall be prepared based on all the activities and analyses performed in the relevant phase. The report shall document status according to design requirements and include reference to analyses, summary of other relevant control activities and summarise any deviations.

A.2.12.3 Input to activity

WEAC from earlier phase

WE/HF studies, verifications, FAT etc.

A.2.12.4 Deliverable

Summary report.

Activity table:

Table 2.2 No Title

Annex	Ref.	Analysis / Activities	Feasibility	Concept	FEED	Detail engineering	Construction	Commissioning	Verification in operation
A	5.4	Perform project activity screening		X	Xu	Xu	Xu	Xu	Xu
		Experience transfer		X	Xu	Xu	Xu		
A,F	4	WE risk assessment - WERA		X	Xu	Xu	Xu		Xu
	5.6	Establish WE area limits (WEAL) and develop WEAC		X	Xu	Xu		Xu	Xu
	4.2.2	Technology evaluation incl. BAT		X					
	5.2	WE input to design basis		X	Xu	Xu			
	5.1	WE program including system for WE follow up		X	Xu	Xu	Xu	Xu	Xu
	4	Manning and organization study including psychosocial and mental work load		X	Xu	Xu			
	4	Task analysis			X	Xu			
	4	WE design review		X	Xu	Xu			
		WE survey /					X	Xu	Xu

		Verification							
		Outdoor operation assessment		X	Xu	Xu			
		Chemical assessment		X	X				
		Illumination assessment			X	Xu	Xu	Xu	Xu
		Noise prediction assessment		X	Xu	Xu	Xu	Xu	Xu
		Participate in constructability study		Xp	Xp	Xp			
		Participate in material handling study		Xp	Xp	Xp			
		Human factor activities							