



Exploration & Production

GENERAL SPECIFICATION

Field Operations

GS EP EXP 403

Production Availability Studies of Oil and Gas Facilities
--

05	01/2012	Update
04	10/08	Update
03	04/06	Update
02	09/03	Change of group name and logo
01	11/02	Update
00	02/01	First issue
Rev.	Date	Notes

Owner: OPS/EXP	Managing entity: OPS/EXP
----------------	--------------------------



Contents

1. Scope and Organisation	3
1.1 Purpose of the specification	3
1.2 Applicability	3
1.3 Organisation	3
2. Reference documents	3
3. Abbreviations & Symbols	4
4. Terms & Definitions	5
5. General methodology	7
5.1 Production Availability Studies Along the Life Cycle of the Facility	7
5.2 Deliverables	8
5.3 Production Availability Study Methodology	8
Bibliography.....	24
Appendix 1 Documents to be provided to the Contractor	25
Appendix 2 Check list for restoration parameters	26



1. Scope and Organisation

1.1 Purpose of the specification

The purpose of this general specification is to provide requirements for the performance of production availability studies (PAS).

1.2 Applicability

This general specification shall apply to all oil and gas installations engineered and/or operated by Total EP. This includes the case of major modifications on existing installations, including the tie-in of a new installation to an existing one.

1.3 Organisation

Within OPS, EXP/SRI holds the technical expertise in probabilistic analysis, modelling and calculation. EXP/SRI advises any DGE entity performing production availability studies in the areas of information, training and technical assistance. This includes:

- Selecting and contracting qualified Contractors ;
- Facilitating relationships between Company and Contractor ;
- Supervising Contractor works all along the progress of the study ;
- Validation and consolidation of the SOW (See §5.3.2) ;
- Qualification of the type of models and tools proposed by the Contractor;
- Validation of results and deliverables ;
- Etc ...

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
ISO 20815	Petroleum, petrochemical and natural gas industries. Production assurance and reliability management

Professional Documents

Reference	Title
Not applicable	



Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP EXP 405	Standard reliability data report

3. Abbreviations & Symbols

CCF	Common Cause Failure
CMF	Common Mode Failure
ESD	Emergency Shutdown
FMEA	Failure Mode and Effects Analysis
IS (MAI)	Injection shortfalls
PS (MAP)	Production shortfalls
MoM	Minutes of Meeting
MTTF	Mean Time To Failure
MTTR	Mean Time To Restore
PAD	Production Availability Diagram
PAS	Production Availability Study
P&ID	Piping and Instrumentation Diagram
PFD	Process Flow Diagram
RBD	Reliability Block Diagram

SIMOPS	Simultaneous Operations
SOW	Scope Of Work
λ	Failure rate
μ	Active repair rate
γ	Probability of failure due to demand

4. Terms & Definitions

Active Repair Time	Part of the maintenance time during which a maintenance action is performed on an item, either automatically or manually, excluding logistic delays Note: it is an intrinsic item parameter, contrary to logistic delays which are in relationship with operation and maintenance policies.
Availability	The availability is the probability that a machine or system will be able to fulfill its required function under certain conditions at a given time. Note 1: Availability considers only two states: "operating" and "failure" and is, thus, very different from production availability. Note 2: Average availability is thus defined as the amount of time during which a component, machine or system was working normally as required.
Consolidated scope of work	Improved SOW obtained from an intensive question/answer process between the Contractor and the Company. This shall be performed at the very beginning of a production availability analysis in order to: - Identify the key indicators to estimate. - Verify that the actual problems are correctly identified
Deliverability	Ratio of deliveries to planned deliveries over a given period of time when the effect of compensating elements such as substitution from other producers and downstream buffer storage is included.
Emergency Shutdown	Control actions undertaken to shutdown equipment or process in response to a hazardous situation.
Failure	Termination of the ability of an item to perform a required function.
Common Cause Failure	Failure of different items resulting from the same direct cause, occurring within a relatively short time, where those failures are not consequences of another (ISO 20815). Note: CCF limits the improvement obtained by implementing redundancy.

Common Mode Failure	Failure of two or more components in the same way,
Critical failure	Failure of an equipment unit that causes an immediate cessation of the ability to perform a required function.
Degraded failure	Failure that does not cease the fundamental function(s), but compromises one or several functions.
Failure mode	Effect by which a failure is observed on the failed item.
Failure Mode and Effects Analysis	Systematic method identifying the effects on a system of each component failure mode. Note: FMEA will be used here to identify the effects on the production of the production facility.
Failure Rate	Probability for an item to fail between t and $t+dt$ provided that it has run without failure over $[0, t]$.
Flaring Policy	Description of flaring consents and constraints..
Flow Diagram	A directed graphical network made of modules representing the various parts of the production system with their given production capacities linked together in order to represent the circulation of the production flow.
Logistic Delays	Accumulated time during which maintenance cannot be carried out due to necessity to acquire maintenance resources excluding administrative delays.
Maintainable item	Item that constitutes a part, or an assembly of parts, that is normally the lowest level in the equipment hierarchy during maintenance (ISO 20815)
Operation Philosophy	Rules describing how the installation is operated. Note: Safety, maintenance, spare part and flaring policies depend on the given production installation. They are likely to have a strong impact on production availability performance.
Preventive Maintenance	Maintenance carried out at predetermined intervals or according to prescribed criteria, and intended to reduce the probability of failure or the degradation of the functioning of an item.

Production Availability	Production availability is the ratio (expressed as a percentage) of actual production over the production forecast for a given period of time. Note 1: It is important to check the parameters of this formula as early as possible since they may vary during the study (production profile, nominations, etc.). Note 2: Actual production figures and the production reference level used to calculate PA must be clearly indicated to facilitate the interpretation of production availability. Note 3: The production availability of several systems does not simply consist of a sum or a product of their respective production availability figures. Note 4: Production availability is not necessarily associated with oil or gas production, but could, for example, concern water, steam, or energy injection, etc.
Production Availability Diagram	A directed graph describing the links between production items and utilities needed to run these items in order to represent the production capacity of the facility under study.
Reliability	Reliability is the probability that a machine or system is able to fulfill its required function continuously under certain conditions over a given time period. Note: This indicator is closely linked to the MTTF.
Reliability Block Diagram	A directed graphical network made of modules linked together to represent the logic of a two states system.
Repair Rate	Probability for an item to be repaired between t and $t+dt$ provided that it is under repair over $[0, t]$.
SIMOPS	Simultaneous Operations (SIMOPS) of production and construction or production and well activity may request that production is partially or completely shut down for safety reasons.

5. General methodology

The relevance of a PAS is improved by using a precise methodology to gather and analyse a maximum amount of data about the system being studied, in order to design a model as similar to the real system as possible.

5.1 Production Availability Studies Along the Life Cycle of the Facility

The level of details and results / deliverable of a production availability study shall be adapted to the life cycle of the oil and gas facility.

Three levels have been identified:

- Coarse production availability study:
 - It is performed during the Pre-Project or Conceptual phase. It provides a decision aid to select the most efficient architecture and aims at establishing which mean production availability is achievable.

- High level production availability study:
 - It is performed during the Basic Engineering phase. It aims at consolidating the results of the coarse study, and at identifying the main contributors to the production losses in order to improve the design.
- Detailed production availability study:
 - It is performed at the Detailed Engineering phase and aims at validating the final design and at orienting the maintenance strategy on the top contributors to production losses so that the design is likely to meet the production availability targets.

5.2 Deliverables

During a production availability study, the Contractor shall provide working documents and a final report.

The working documents allow the Company to follow the work progress and to detect any difficulty as soon as possible. These documents shall be produced according to the general methodology presented in §5.

The actual content and the level of detail of those documents depend on the level of analysis (coarse, high or detailed) and of the size of the system under study.

The final report is based on the material contained the working documents and is published at the end of the study.

5.3 Production Availability Study Methodology

5.3.1 Main steps

Whatever the level of detail of the production availability study the Company shall prepare a detailed scope of work (SOW) defining namely:

- The objective of the study and its context;
- The boundaries of the system(s) under study;
- The expected level of details of the study;
- The parameters to be evaluated;
- The deadline for the issue of the deliverables.
- Attached to the above SOW the Company shall provide all the documents allowing the Contractor to understand the scope of work and prepare his commercial offer for the work. Depending on the phase in the life cycle this should also include PFD's, PID's, operation and maintenance philosophies, safety logic diagram, and any other relevant documents available.

Whatever the level of detail and based on the SOW, the Contractor shall make a work proposal based on a lump sum and structured in nine steps:

1. Definition of targets and of battery limits.
2. Consolidation of the scope of work;
3. Identification and analysis of the functions of the oil and gas facility;

4. Writing and gathering of assumption sheets;
5. Reliability data gathering;
6. Causes and effects analysis of the events inducing a production loss;
7. Production availability modelling and calculations;
8. Reporting
9. Schedule

5.3.2 Targets, battery limits and SOW consolidation

The following shall be strictly adhered to by both the Company and the Contractor:

- Terminology and definitions presented in chapter 4 are used;
- All utilities (electrical power, fuel gas, gas lift, compressed air, ...) are listed and those to be discarded in the study are agreed by the Company;
- Operation constraints are listed and those to be discarded in the study are agreed by the Company. This may include but is not limited to:
 - Maintenance policy, flaring policy, production policy, water injection policy,
 - Evolution of the production potential,
 - Spare part policy, mobilisation of resources policy,
 - Preventive maintenance, well maintenance and testing / monitoring,
 - SIMOPS,
 - Gas nomination,
- All external constraints (e.g. due to third party) are identified and those to be discarded for the study are agreed by the Company;
- The flows (export oil, export gas, injected water, flared gas, ...) to be considered are clearly identified;
- Etc.

The SOW shall be consolidated within step 2 to avoid any misunderstandings between Company and Contractor. The consolidated SOW shall be written by the Contractor once he has got sufficient knowledge of the study and this shall be covered in the lump sum proposal.

5.3.3 Analysis of the functions

Step 3 aims to identify and analyse:

- The various functions of the system under study which participate to the production (e.g. compression, ...), the various units belonging to these functions (e.g. compression train, ...) and, depending of the level of detail of the production availability study, the various pieces of equipment belonging to these units (e.g. inlet scrubber);
- The functional links between the above elements for the purpose of the production availability study;
- The redundancy levels.