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ESS System Documentation prior to a Safety Readiness Review

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1. SYSTEM DOCUMENTATION

This is the general description of ESSMS documentation needed for any given system prior to a Safety Readiness Review (SRR).

It is possible to provide one (1) concluding document containing the sections below, and then refer to underlying documents that are made available to the SRR committee in parallel to the concluding document.

For each section below, there is a description of the expectations for the specific topic.

1.1. Design descriptions

This section should contain a description of the purpose of the system and the technical solution, derived from relevant stakeholder requirements.

For instance, describing the Ion Source (IS) and the Low Energy Beam Transport (LEBT).

Note: The stakeholder requirements can be provided in a reference.

1.2. Architecture description

Description of the specific system, involved equipment and devices.

This section provides a description of the specific system to be evaluated and the interfacing systems. Interfaces include those system or components that must be operable in order to perform testing as well as those interfacing systems that must be isolated from the item to assure safe testing of the item.

The description could for instance be provided according to the example of structure of involved systems shown in appendix 1, where the System of interest is described together with belonging Sub-systems (Supporting systems, Safety systems, etc).

Provide also appropriate pictures and schematics as necessary to show the system and associated systems.

1.3. Concept of Operations

This section provides the scope of proposed testing.

It should contain descriptions of operation modes of the system, including maintenance.

Also, descriptions of needed operators, their specific disciplines and their belonging training requirements.

Further, a list of the specific individuals that are qualified to operate the system or specific equipment of the system (e.g. instrumentation specialist).

1.4. Requirements Specification

Test envelope limitations and conditions

Descriptions of operational limits and conditions for the specific system test envelope, both for the system to be tested and any interfacing systems required during the test.

The test limits and corresponding action levels shall be clearly defined.

Note: The test envelope is intended for the specific test to be performed, which could differ from the future Operational envelope and the corresponding future Safety envelope, but all should consider relevant hazards for the specific activity.

Hazard identification

Description of the performed hazard identification work together with the specific hazards that have been identified.

The hazard identification shall include identification of all the hazards associated with the system processes, associated operations, work activities, component failures, human errors, and aggressors considered external to the specific system of interest.

One must consider process and external events that may upset the device or adversely influence planned controls. This includes potential impacts from operations not directly associated with the system, but others that are operating in the same area of the facility.

The description shall include characterization of the identified hazards (radiation, fluids, gases, proton beam, pressure, temperature, earthquake, etc.).

Safety systems, belonging administrative procedures and their limits and conditions

Descriptions of the derived requirements for safety systems (engineered controls) together with a description of the administrative procedures (administrative controls) which should include both the perspective of prevention and mitigation.

Provide also information on required personal protective equipment.

Finally, provide procedures describing handling of deviation from the testing envelope, how it is evaluated and reviewed, before proceeding with the activities.

1.5. Interface descriptions

Describe interfaces and boundaries to surrounding structures, systems and components of interest. For instance, access control, ventilation, power supply, etc.

Describe especially specifications of the interfaces that

- must be isolated prior to performing testing.
- must be verified as operable prior to performing testing.
- must be verified as operable prior to declaring readiness for operation
- might interrupt readiness if the interface is shut down

1.6. Integration Plan

The integration plan is expected already in connection to the Critical Design Review (CDR) and includes intermediate demonstrations (for instance for belonging supporting systems and/or safety systems) finally leading to test readiness of the specific system of interest.

This section can refer to already performed verification of required subsystems that for instance could be a supporting systems and/or safety systems.

1.7. Operation and maintenance documents

Description of the allowed testing envelope from an operator point of view. Should correspond to the description of the test envelope in the first section of 1.4, even though the description in 1.4 could be intended also for other stakeholders (engineers, scientists, etc.) and thereby provide more details than those specifically needed for the operators which should be more hands-on related.

Descriptions of the specific operating and maintenance procedures, including lock-out/tag-out procedures, energy control procedures, calibration procedures, maintenance procedures, etc.

A list of the safety systems (engineered controls) together with alarm response procedures (administrative controls), that shall be available for the operators.

Description of handling procedures for hazardous material and waste.

1.8. Verification Plan

Description of the system verification plan, showing the detailed steps to be followed to verify and ensure that a product or system meets its specific list of requirements.

The verification plan defines;

- who does the verification;
- when and where it is to be done;
- the responsibilities of each participant before, during, and after each verification;
- the hardware and software to be used (and other systems if applicable);
- and the documents to be prepared as a record of the verification activity.

The verification plan could also consider validation plans, and even validation reports, from underlying subsystems.

Prior to any verification activity a Test Readiness Review (TRR) will assess the maturity of the resources for supporting the verification activities for a system (test stand accessibility, test equipment readiness, availability of the personnel).

In addition to the TRR a Safety Readiness Review (SRR) then independently assess safety.

1.9. Verification Report

Identifies the type of verification performed and reports on the results of the verification activities.

In addition, it should also cover descriptions on “Lessons learned” in order to share gained experience from the performed activities, in internal and external experience exchange.

2. GLOSSARY

Term	Definition
SRR	Safety Readiness Review
IS	Ion source
LEBT	Low energy beam transport
HV	High voltage
PSSO	Personal Safety System, specifically intended for the Ion source and LEBT
CDR	Critical design review
TRR	Test readiness review

3. REFERENCES

- [1] ESS-0091812, ESS Project Management Handbook
- [2] ESS-0003688, Configuration Management Plan
- [3] ESS-0005380, ESS Construction Phase Management Plan
- [4] ESS-0041755, ESS Guideline for Radiological Hazard Analysis
- [5] ESS-0118414, ESS Process Owner for Safety Readiness Review

DOCUMENT REVISION HISTORY

Revision	Reason for and description of change	Author	Date
1	First issue	Thomas Hansson	2017-10-27

Appendix 1

Example of how to describe the structure of involved systems

<u>Systems of interest</u>	Ion source	gas delivery system, plasma generator/microwave system, extraction system, isolation transformer, cooling system, vacuum systems
	LEBT	magnetic solenoids, steering magnets, slit IRIS, deflecting chopper, beam collimator, beam diagnostics instruments, gas injection system
<u>Supporting systems</u>	HV power supply
<u>Safety systems</u>	IS HV cage	fence and gate
	Shielding	against ionizing radiation against electromagnetic fields
	PSSO	detectors sensors logic circuits/equipment actuators interlocks