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Target Project Quality Plan

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TABLE OF CONTENT **PAGE**

LIST OF APPENDICES

SUMMARY

The purpose of the Target Project Quality Plan is to describe the measures that will be taken to ensure that the Target Project components and systems meet quality objectives.

Quality requirements are intended to be applicable to all project participants, i.e. ESS Target Project team, service contractors, equipment suppliers, and In-Kind Partners, encompassing all activities performed by, or for, the Target Project, from design through equipment and facility acceptance and turnover to operations. Operative processes used by the Target Project team for design, analysis, document control, planning, earned value management, risk management, and use of sustainable materials are also defined. Finally, support activities intended to help fulfill the quality goals of the project are defined.

1. SCOPE

The Target Project Quality plan describes the quality framework, which uses a graded approach based on consideration of potential effects of system quality on various critical outcomes for European Spallation Source ERIC (hereinafter referred to as ESS), to establish quality requirements for work activities.

This plan covers a variety of systems, components, and activities. Quality assuring actions shall be applied commensurate with needs. Three grade levels (quality levels) are defined:

1. Serious potential impacts, requiring a rigorous series of actions.
2. Important potential impacts, negative or positive, justifying a disciplined set of actions.
3. Routine potential impacts, justifying routine actions.

Tables 1 and 2 explain the process. The first step is determining the grade level in Table 1, and then applying appropriate actions from Table 2. To determine the grade and subsequent actions for an item or activity, locate the appropriate risks on the matrix in Table 1. The most serious identified risk determines the grade.

Systems, structures, or components will be evaluated before approval of completion of Preliminary Design to establish their appropriate Grade Level using a simple checklist (see Appendix 1). This checklist will form part of the Allocated Baseline and will be maintained in the ESS document control system CHESS.

A flow diagram for this process is illustrated in Figure 1.

The document includes guidelines regarding quality assurance activities to the safety classified SSC. It also includes how to involve the In-Kind Partners or subcontractors in the Target Project Quality Plan.

2. INPUT TO THIS QUALITY PLAN

The key inputs to this quality plan are from the ESS Management Systems (ESS MS).

ESS MS is a framework of management documents consisting of a pyramid hierarchy:

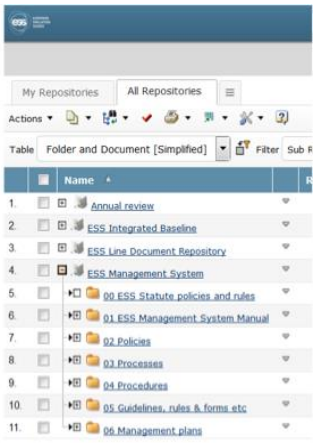


Figure 1 ESS Management System

ESS MS documents are stored and managed in ESS' Product Lifecycle Management (PLM) system, Configuration Home for ESS (CHESS). The ESS MS is a 'living' framework and database system, under continuous development.

ESS MS Policy for Quality, Process for Quality Management and Management Plan for Quality are described in [15].

3. QUALITY GOALS

The Target Project quality goal is to ensure that the project is being managed, developed, and deployed in a sound, reasonable way, and that the project's deliverables are of acceptable quality. More specifically, the Target Project quality program is focused on enhancing the processes for design, fabrication, installation, and testing of the equipment and facilities to improve definition of quality requirements and applicable codes and standards, improve design for manufacturability, and confirm equipment operability. Verification that the Target Project meets its high level requirements is described in the System Verification Plan: Target Station document. [9]

The description of how requirements will be verified for lower level systems are developed as a deliverable document required for completion of the preliminary design phase. These documents are reviewed and revised at the completion of each of the subsequent project phases.

4. MANAGEMENT RESPONSIBILITIES WITHIN THIS QUALITY PLAN

The Target Project quality program also implements the quality assurance program defined in the ESS Management Plan for Quality in a way that achieves adequate protection of the workers, the public, and the environment, taking into account the work to be performed and the associated hazards and ensuring the performance of the equipment as designed. [1]

Target management is responsible to ensure project quality by:

- Planning and executing all Target Project work in accordance with the values stated in the ESS Quality Policy and the requirements specified within the ESS Management System
- When applicable fulfill the requirements in “ESS Rules for Quality Regulation - Mechanical Equipment” [11]
- Developing and providing clear communication directives and documents to project members and stakeholders
- Participating in audits of management processes
- Conducting assessments of project elements as they pass from one project phase to another
- Conducting reviews for all project elements to support the assessment process
- Establishing and utilizing processes for dealing with deviation requests and non-conformances in the process of procuring equipment from suppliers
- Working with In-Kind Partners to establish and verify quality plans that ensure that project quality goals are met
- Working according to reviewed and formally approved work instructions
- Controlling changes to ensure changes are verified and validated as well as ensure traceability
- Applying a risk based approach that focuses appropriate levels of project resources and management attention on systems, structures, and components based on consideration of various critical outcomes for ESS, i.e. graded approach

ESS utilizes an Earned Value Management System based on the PMBOK standard to track performance, manage cost and schedule variances, take corrective actions, and project future budget and schedule performance. Monthly project performance meetings are conducted to review progress at the Work Package level with the Target Project and similar meetings are held monthly by ESS management to review progress at the Project level.

The Target Project utilizes the ESS Risk Management Process to identify, analyse, and mitigate Project risks. ESS employs the Exonaut software system as a tool to help manage this information. In-Kind Partners are allowed to utilize their own system, but the European Spallation Source ERIC Technical Coordinator for each specific In-Kind Agreement Schedule elevates any medium or high risk identified through by the In-Kind Partner to the Target Project risk registry within Exonaut.

5. DOCUMENTATION AND STORAGE OF DATA

Document control is handled through the ESS document control system provided in CHESS. Target Project personnel as well as suppliers and In-Kind Partners will be authorized to input documents to CHESS as well as access documents from CHESS. Where needed, appropriate reviewers and approvers for documents will be identified by the appropriate management level, i.e. reviewers and approvers for documents within a work package will be set by the appropriate Work Package Manager, whereas Target Project level documents or interface documents between one work package and other work packages will be set by the Target Project Manager.

Reviewers and approvers for the core documents are defined in “Target Project Process for Project Phase Transition” [4].

General procedures for the Target Division Document are described in the “Target Document Guideline” [16].

All documents describing and supporting the technical baseline are uploaded to the ESS document control system, which utilizes CHESS. CATIA version 6 is used for CAD modelling of equipment layouts and detailed description of mechanical systems. Other tools may be utilized for piping and electrical drawings. In-Kind partners will utilize CATIA version 6 or provide step models to the Target Project team in Lund for integration into the overall model of the Target Station.

Project planning is conducted utilizing Primavera P6 software. The Target Project plan in P6 is fully resource loaded. In-Kind partners will be allowed to utilize other software, but the Target Project team will incorporate enough data from our Partner’s plan to track progress.

6. CONTROL OF RECORDS WITHIN THIS QUALITY PLAN

Quality Records, including design review reports, manufacturing verification reports, system verification reports, corrective action requests, and non-conformance reports, will be uploaded to the ESS document control system that utilizes CHESS. Quality records from In-Kind partners are defined as one of their deliverables. The Target Project Technical Coordinator for each In-Kind Agreement Schedule is responsible for ensuring that this transfer and upload to CHESS occurs.

7. RESOURCES

7.1. Materials

The Target Project plan for ensuring the use of sustainable materials is described in the TS Plan for Sustainable Selection of Materials document. [6]

7.2. Human Recourses

To design, manufacture, install and commission the target station, the Target Division consists approximately 50 staff. In addition, in-kind partners are responsible for the design and delivery of approximately half of the target station hardware, as measured by cost of design and manufacture. Competencies needed in the design and manufacturing phases include project planning, design engineering, CAD engineering, fluid systems engineering, structural analysis, HVAC engineering, materials science, chemistry, radiation transport simulation, and software programming. In the installation phase, competencies needed include crane operation and heavy lifting, welding, machining, mechanical crafts, electrical crafts, and ventilation crafts. During the commissioning phase, the competencies needed include system operators, operations engineering, mechanical and electrical technical support.

7.3. Infrastructure and work environment

Policies, Processes, Procedures and Guidelines are described and documented in the ESS Management System Manual [15]. The ESS Management System is developed in order to:

- Ensure compliance with the requirements and expectations of the stakeholders
- Enable the organisation to achieve ESS's objectives and targets
- Reduce risks by working in a structured manner
- Secure the application and improve the overall management of processes within ESS
- Document ESS's best business practices
- Enhance the credibility of ESS and strengthen the core values

All documents important to design, manufacture and operate the ESS facility are stored in CHESS.

8. REQUIREMENTS

This plan provides requirements applicable to all project participants, i.e. ESS team, service contractors, equipment suppliers, and In-Kind Partners, encompassing all activities performed by, or for, the Target Project, from design through equipment and facility acceptance. Additional equipment specific QA plans and procedures may be developed by the fabricating vendors and In-Kind Partners, which will apply to work in their areas of responsibility. Each vendor or In-Kind Partner organization shall work within its own ESS Target Project approved QA or management plan and procedure system, which must comply with the requirements in this plan.

All IN-KIND PARTNER national safety laws and legislation applicable to the design, development, manufacturing, installation, testing and operation of the supply shall be followed and fulfilled.

Technical requirements are handled in the interface control documents (ICD and ICD-R). These documents describes requirements between systems. Requirements specific to each work package are documented in the System Definition Document – Requirements (SDD-req).

Each In-Kind partner or subcontractor is required to hand over a specific project quality plan to the Target Division clarifying how they will ensure that QA requirements defined in this document will be fulfilled.

9. CUSTOMER COMMUNICATION

The Work Package Manager has the main responsibility for communication to the In Kind Partner or subcontractor. In the technical annex to each In Kind Agreement, mandatory activities to promote communication are defined. The activities include Kick Off Meeting, status meetings and status reports. In addition to these activities, meetings coupled to the Target Technical Board and Target Collaboration Board are performed. Day-to-day meetings, email, phone or visits supplement the formal activities. These informal activities are important to secure that QA activities are performed as intended.

10. DESIGN AND DEVELOPMENT PROCESS

The design and manufacturing will be performed either in house ESS (self performance) or in collaboration with an In Kind Partner. Contractors and subcontractors will also be used, in the design and development process, either by ESS or by the In Kind Partner. Regardless of the individual work package organization, reviews according to "Target Project Process for Project Phase Transition" [4] will be executed.

If the design and development are performed in house by ESS, procedures established by the Design and Engineering Group will be used. [12]

If the design and development are performed in collaboration with an In Kind partner, procedures within the In Kind partners will be used. [13]

Normal industrial standard in accordance to each specific work package will be used. If the system is included in SSM special conditions to ESS in Lund [14] the design and manufacturing shall fulfil these conditions. QA procedures how to fulfil the conditions are stipulated in [11].

Various engineering analysis codes are used to support design of the Target Project subsystems. Industry standard codes such as ANSYS for structural and thermal-hydraulic calculations are used. MCNPX is used for neutronics and radiation shielding calculations. The process for assuring accurate determination of ionizing radiation shielding requirements is described in the ESS Procedure for Designing Shielding for Safety document. [5]

The process for change control at the ESS level is described in the ESS Configuration Management Plan of the ESS Programme, while at the Target Project level change is managed as described in the Target Baseline Management Process. [8] [2]

11. PURCHASING

Target Project personnel requesting procurement of items and services are responsible for providing technical, quality, ES&H, and other specifications to the ESS procurement organization that adequately describe the item or service being procured so that the supplier can understand what is desired and what will be accepted. Development of these specifications may be achieved through the involvement of QA representatives and through established review and approval systems. The following factors should be considered:

- technical performance requirements,
- appropriate standards,
- laws and regulations, and
- acceptance criteria.

Suppliers of quality level 1 or 2 items or services should be evaluated to determine their ability to provide acceptable items and services. The evaluation typically includes reviews by representatives from the ESS Quality Division. Quality Division approval is mandatory for level 1, and consultation is required for level 2 procurements, as noted in the graded approach Table 2.

Previously accepted suppliers should be appropriately monitored to ensure that they continue supplying acceptable items and services. Source surveillance is the recommended method to ensure that items are free of damage and that specified requirements were adequately met. Incoming items will be verified against previously established acceptance criteria.

Unacceptable items or services should be documented in a formal non-conformance report. A record of supplier performance will be kept for future procurement consideration.

Counterfeit/suspect parts are prohibited. Inspections will be used to detect violations. When counterfeit/suspect parts are found, they will be identified, segregated, removed from usage, and reported to ESS management.

In-Kind Partners are expected to utilize comparable levels of control of non-conforming products.

The In Kind partner responsibilities regarding procurement are defined in the technical annex to each work package.

Acceptance of deliverables from suppliers and in-kind partners will be defined in contracts or agreements. As stated in “Target Baseline Management Process”, acceptance of integrated systems will follow from the process defined in “System Verification Plan” documents and recorded in “System Verification Reports.” Acceptance of the entire Target Station will come just prior to first beam-on-target and result from a positive outcome of the final Accelerator Readiness Review.

12. PRODUCTION AND SERVICE PROVISION

One of the Target Project team’s primary responsibilities is to integrate the work performed by our subcontractors, suppliers, and in-kind partners. Integration of the contributions of our in-kind partners is an especially significant role for the Technical Coordinators for specific in-kind work elements. Interface control documents are the primary mechanism for ensuring that interface requirements are properly established and agreed. Integration meetings are held regularly both within Target Project and with other ESS projects to discuss and resolve integration issues. Target Project also provides and receives regular updates to the integrated ESS CAD model.

12.1. Installation and post-delivery activities

During concept design and final design the verification and validation plan to each work package is elaborated according to [4]. The verification and validation is then finally completed during the Integrated Systems Testing.

If an In Kind partner is involved, their responsibility and deliverables regarding installation and post-delivery activities are described in the technical annex.

13. IDENTIFICATION AND TRACEABILITY

Security of the project information with regard to integrity and availability is managed centrally within ESS through the CHESS software system. Security agreements related to supplier’s proprietary information and intellectual property is addressed within each contract. Provisions for handling In-Kind Partners within the Target Collaboration, i.e. collection of In-Kind Partners, is addressed in the In-Kind Agreement contract as well as the Target Collaboration Agreement. [7]

All system, components and other mechanical equipment shall have permanent and unique identity marking. [11]

14. CUSTOMER PROPERTY

N/A since ESS is not a supplier company.

15. PRESERVATION OF PRODUCT

N/A since ESS is not a supplier company.

16. CONTROL OF NONCONFORMING PRODUCT

In general, non-conformities will be dealt with using the common approach described in the ESS Process for Non-Conformities and Improvements document. [10]

Appropriate action will be taken both to mitigate the impact and/or to prevent the occurrence of non-conformities, and opportunities for improvements will be assessed and when relevant will be implemented.

More specifically, procurement controls will be implemented to ensure that purchased items and services meet project needs and comply with applicable quality requirements.

17. MONITORING AND MEASUREMENT

Assessment processes that will be used for passing from one project phase to the next have been established and communicated to the project team. The phases of the project and documentation required to verify completion of the required work are described in the Target Baseline Management Process, which is patterned after the ESS Systems Engineering Management Plan, and are further detailed in the document entitled Target Project Process for Project Phase Transition. [2] [3] [4]

The Target Change Control Board will be utilized to conduct the assessment and approval of completion of each project phase, except the final one, i.e. transition to operations, which will be approved by the ESS Programme level CCB.

The ESS Programme and Target Project also conduct external assessments, such as the Annual Review and Technical Advisory Committee Meetings, to provide an objective view of performance and as a result contribute to the independent assessment process. Target Project management utilizes these assessments to verify and validate progress and adjust plans for future work. Responses to the recommendations from these assessments are developed and tracked to closure.

Reviews will be utilized to support the assessment process for passing from one project phase to another. This will include Preliminary Design Reviews (PDR), Critical Design Reviews (CDR), Test Readiness Reviews, System Acceptance Reviews, and finally the Operational Readiness Review. These reviews will be conducted using a graded approach with first-of-a-kind, performance critical or safety-related items receiving the highest level of review, usually including external experts, and commercial-off-the-shelf items with no safety function receiving the lowest grade review, typically covered by line management review and approval.

PDRs and CDRs will be conducted by individuals or groups depending on their graded-approach categories. The review committee panel will be established by the Target Project Manager. The

adequacy of design inputs, processes, outputs, and changes shall be reviewed using a graded approach as follows:

- Level 1. Review by individuals or groups independent from those who created the design and who will not benefit from any lack of objectivity. The committee panel will also include representatives from systems with major interfaces, Quality Division, and ES&H Division.
- Level 2. Review by individuals or groups other than those who created the design but who may be supervised or managed by the same person. The committee panel will also include representatives from systems with major interfaces, and may include representatives from the Quality, and ES&H Divisions.
- Level 3. Some independent review as a recommended practice.

A more detailed description of the review processes is provided in the Target Project Process for Project Phase Transition document. [4]

Equipment used for inspections and tests shall be calibrated and maintained. Calibration will be controlled by a system or systems making appropriate use of qualified calibration service providers, equipment calibration-status tracking database(s), and approved methods for adding equipment items to the controlled system. The ESS Quality Division will oversee and support the calibration system.

18. AUDITS

In coordination with the ESS Quality Division, audits of management processes will be conducted on a regular basis in compliance with ESS Program quality plan as well as licensing authorities.

The purpose of these audits is to assist managers in identifying opportunities for quality improvement and to ensure compliance with specified requirements.

19. IMPLEMENTATION AND REVISION OF THE QUALITY PLAN

19.1. Review and acceptance of the quality plan

The Target Project Quality Plan is reviewed by the ESS QA department and approved by the head of the Target Division. New revisions of the Target Project Quality Plan will also be reviewed by the ESS QA department and approved by the head of the Target Division.

19.2. Implementation of the quality plan

The Target Project Management Team is responsible for the implementation and follow-up of the Target Project Quality Plan. Each Work Package Manager within the Target Project is also responsible for the In-Kind Partner or the subcontractor alignment to the Target Project Quality Plan.

Processes, Procedures and Guidelines included in the ESSMS will be used to secure that project activities are performed in accordance with the Target Project Quality Plan.

19.3. Revision of the quality plan

The Target Project Management Team is responsible for the continuous evaluation of the Target Project Quality Plan. The need for changes or additions are discussed in the Target Project Management Team meetings.

19.4. Authorized deviations to this quality plan

Deviations to the Target Project Quality Plan will be documented and approved by the head of the Target Division.

20. GLOSSARY

Term	Definition
ESS	European Spallation Source
CAD	Computer Aided Design
CDR	Critical Design Review
ESSMS	ESS Management System
PDR	Preliminary Design Review
PMBOK	Project Management Body of Knowledge

21. REFERENCES

[1] ESS Management Plan for Quality, ESS-0018636.
[2] Target Baseline Management Process, ESS-0016499
[3] Systems Engineering Management Plan, ESS-0002908
[4] Target Project Process for Project Phase Transition, ESS-0037005
[5] ESS Procedure for Designing Shielding for Safety, ESS-0019931
[6] TS Plan for Sustainable Selection of Materials, ESS-0017560
[7] Target Collaboration Agreement, ESS-0027133
[8] ESS Configuration Management Plan of the ESS Programme, ESS-0003688
[9] System Verification Plan: Target Station, ESS-0005859
[10] ESS Process for Non-Conformities and Improvements, ESS-0008370
[11] ESS Rules for Quality Regulation - Mechanical Equipmen, ESS-0047989
[12] Interaction between ESS design and supplier ESS-0002578
[13] Collaboration between ESS design and in-kind contributor ESS-0002750
[14] SSM special condition to ESS Lund, ESS-0015358
[15] ESS Management System Manual, ESS-0008201
[16] Target Document Guideline, ESS-0097484

DOCUMENT REVISION HISTORY

Revision	Reason for and description of change	Author	Date
1	First issue	Ulf Odén	2017-02-23

Table 1. Determination of Quality Level or Grade

	Level 1. Serious Consequences	Level 2- Important Negatives	Level 2+ Important Positives	Level 3. Routine
Environment Safety, and Health	Potential for (1) a death or total disability or severe adverse impact on the health or safety of a worker or the public, or (2) environmental damage that could exceed regulatory limits or involve significant clean-up costs, or (3) threatening the function of a safety-credited system, structure, or component	Potential for injury or illness requiring hospitalization, temporary or partial disability, or moderately adverse impact on the environment or health or safety of a worker or the public, including such potential through affecting safety-credited functions	Significant potential for *reduced* injury or illness rates requiring hospitalization, temporary or partial disability, or *reducing* adverse impact on the environment or health or safety of a worker or the public, including such potential through affecting safety-credited functions	Only minimal impact on the health and safety of the public or a worker, such as injury or illness requiring minor supportive treatment but not requiring hospitalization. Negligible impact on the environment
Compliance	Significant potential for noncompliance with applicable laws and licensing requirements	Significant potential for noncompliance ESS procedures, or minor noncompliance with applicable laws and licensing requirements	Significant potential for *improving* compliance with ESS procedures, or reducing/ eliminating minor non-compliances with applicable laws and licensing requirements	Potential for minor noncompliance with established management practices
Functional	Potential for a significant adverse impact to achieving or maintaining key performance and reliability goals of the ESS	Potential for important adverse impact to a major system or component, but not blocking ESS from key performance goals	Potential for important *positive* impact to a major system or component, or important to ESS achieving key performance goals	Potential for negligible impact to an ESS task, system, or component
Financial	Potential for unintended cost of 1 M€ or greater	Potential for unintended cost of 0.2 M€ or greater	Potential for reducing cost by 0.2 or greater	Financial risk is less than 0.2 M€
Public/Governance Interest	Significant potential for loss of public or governance confidence in ESS or its management	Some potential for reduced public or governance confidence in ESS or its management	Important potential for enhanced public or governance confidence in ESS or its management	Little or no potential for reduced public or governance confidence

Table 2. Requirements for Work Activities Chosen Based on Quality Levels

Level 1. Rigorous	Level 2. Disciplined	Level 3. Routine
Documented worker qualifications[1, 2]	Knowledgeable personnel employed, and compliance with ES&H requirements[1, 2]	Knowledgeable personnel employed, and compliance with ES&H requirements[2]
Design reviews and *independent* verifications[1]	Design reviews and verifications[1]	Informal or no design reviews, verification
Thorough documentation (plans, drawings, specifications etc.) [1]	Adequate and appropriate documentation (plans, drawings, specifications etc.) [1]	Minimal documentation
Vendor qualification and surveillance[1]	Vendor qualification[1]	Little or no vendor qualification
Approved documented procedures[1]	Procedures as needed	Procedures other than safety may be informal
Complete oversight and assessment activities[1]	Oversight by general management assessments	Oversight performed by line supervision
Controlled measuring and test equipment[1]	Controlled measuring and test equipment[1]	Measuring and test equipment generally not used
Formal inspection and testing[1]	Tests and inspections conducted appropriately[1]	Normal receipt inspection only, plus any ES&H requirements

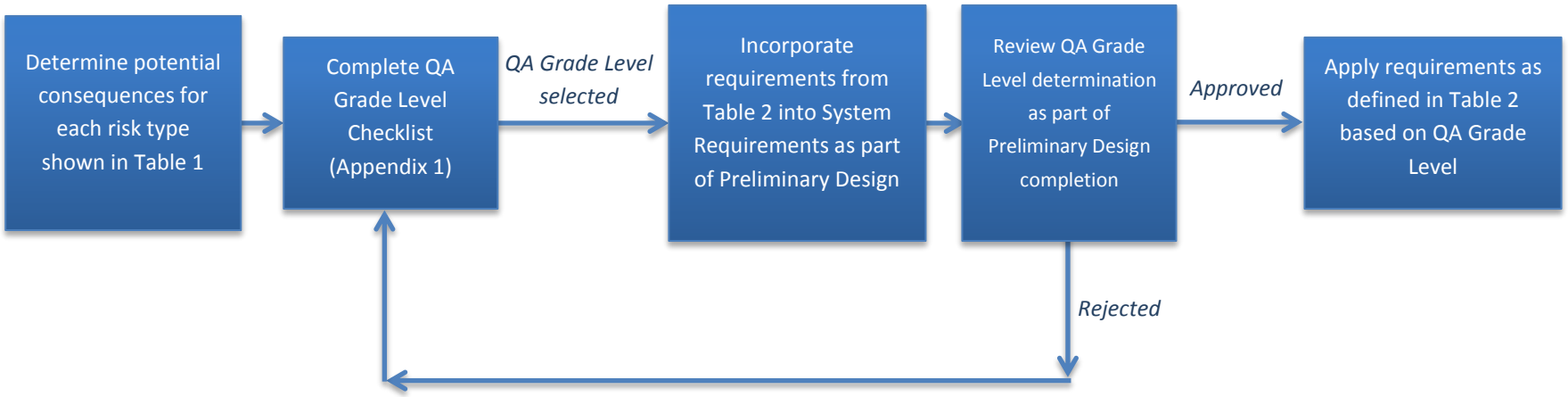
1 QA representative approvals or concurrences are required.

2 For tasks that may affect safety and health, only trained and qualified personnel may perform tasks unsupervised

NOTES:

a) Records are required to be maintained within the ESS document control center for the actions listed as required for grades 1 and 2.
b) Exceptions to specific requirements for a given QA Grade Level require should be stated on QA Level Determination Form (Appendix 1).
c) Additional QA and QC requirements beyond those identified in this table may be required for some items to satisfy applicable codes and standards or licensing/regulatory requirements, e.g. RCC-MRx Class 1-3 for designated systems or components or third party inspections.

Figure 1. Process flow diagram for establishing and implementing QA grade level.



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APPENDIX 1

ESS Target Project

QA LEVEL DETERMINATION FORM

ESS Target Project

QA LEVEL DETERMINATION FORM

WBS Element Description: _____

WBS Element Number: _____

Results of risk-based analysis (Check the box indicating the appropriate Level according to the guidance provided in Table 1 of ESS-0027134):

Risk Type	Environment, Safety, and Health	Compliance	Functional	Financial	Public/Governance Interest
Level	1 2 3 ☐ ☐ ☐	1 2 3 ☐ ☐ ☐	1 2 3 ☐ ☐ ☐	1 2 3 ☐ ☐ ☐	1 2 3 ☐ ☐ ☐

Level 1=Serious Consequences, Level 2=Important positives or negatives, Level 3=Routine

Comments (e.g. rationale for Level 1 or 2 designations): _____

_____

_____

_____

Overall QA Grade (typically the lowest number checked above): **1** ☐ **2** ☐ **3** ☐

Exceptions to specific requirements stated in Table 2 of ESS-0027134 (including rationale):

_____

_____

_____

Prepared by: _____
Initiator/Date

Approved by: _____
Work Package Manager/Date

Concurrence: _____
ESS Quality Division Representative/Date