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EXTERNAL REFERENCE / VERSION

MQP Level 3

Design Review Procedure

This document describes how to conduct IO Design Reviews on ITER Systems. It is applicable to all the Conceptual, Preliminary and Final Design Reviews performed by IO on the ITER Project.

Approval Process			
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Previous Versions Reviews	**Chiocchio S.** **Cordier J.- J.** **Elbez-Uzan J.**	**09 Dec 2019:recommended v4.2** **12 Dec 2019:recommended v4.2** **12 Dec 2019:recommended v4.2**	**IO/DG/COO/CIO/CMD** **IO/DG/COO/CIO/DCIN** **IO/DG/RCO/SD/EPNS**
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Change Log			
Design Review Procedure (2832CF)			
Version	***Latest Status***	***Issue Date***	***Description of Change***
v1.0	Signed	08 Apr 2008	
v1.1	Signed	21 Apr 2008	
v1.2	Signed	28 Apr 2008	
v1.3	In Work	29 Apr 2008	
v1.4	In Work	01 Jul 2008	
v1.5	In Work	01 Jul 2008	
v1.6	Signed	01 Jul 2008	
v1.7	Approved	10 Jul 2008	
v1.8	In Work	15 Oct 2008	
v1.9	Approved	24 Oct 2008	
v1.10	Signed	15 May 2009	
v1.11	Signed	06 Aug 2009	Incorporated organization changes, action tracking system, design review checklists, review panel report, and a statement of review panel members.
v1.12	Approved	11 Dec 2009	Incorporated QA comments (that is, description of CDR and PDR, and application of checklists), RH Compatibility Procedure, System Structural Integrity Report and System Load Specification.
v1.13	In Work	24 Nov 2010	Draft version for pre-review.
v2.0	Signed	14 Dec 2010	For clarity purpose, Design Review procedure Version 1.13 has been split in 3 separate documents: 1) Top level considerations (Objectives, various DRs, authorities (approval, etc), roles…), 2) how to perform activities [this procedure] and 3) guidelines for the maturity of documents at each stage (CDR, PDR and FDR).
v2.1	Signed	29 Jun 2011	Simplified version worked out by TF-CIE incorporating a Design Review simplified worflow
v2.2	Signed	17 Jan 2012	Comments made on v 2.1 taken into account (mainly QA comments)
v3.0	Disapproved	27 Feb 2012	Same version as v2.2 (add new reviewers and change approver). Plus Design Developer can be invited for clarification during the chit merging and categorization
v3.1	Approved	30 Nov 2012	Incorporated comments from v3.0, TF3 ITER_D_A6SMQN - Task Force 3 - Final report and ITER_D_C2HS2K - 2012 Management System Audit 47 - Design Review Process. Aligned with the Design Review Management Plan [1]
v3.2	Approved	01 Jul 2014	Updated to align with current requirements; • Minor comments from last version v3.1, • New organization: CIEH replaced by DIPH or Chief engineer, • CEA participation as decommissioning experts (new terms of reference from AIF), • Alignment with the Design Plan expected from each System-RO (as a consequence Appendix B has been removed) • Use of the new MQP template (as a consequence some Sections have been re-distributed)
v4.0	Revision Required	19 Oct 2016	Main changes are: • Update of acronyms and alignment with names of the units, • Incorporation in the procedure of some elements already implemented (list of qualified Chairs...) • Better definition of the timing in the preparation of the design review meeting and the issuance of documents, • Better definition of the content of the input package, the content of the Chit, the review and approval of the generated documents. • Request that the draft action plan is produced before the end of the review in a “Close-Out session”.

			Overall this update is incorporating recommendation from some experts (Tom Todd, Franck Casella,…)
v4.1	Approved	02 Dec 2016	Procedure was updated according to reviewer's comments.
v4.2	Revision Required	06 Dec 2019	Updated to account for the IO organization effective Jan. 2020
v4.3	Approved	17 Dec 2019	Aligned with new IO Organization, defined SIRO role in support to the Design Developer, input data package connected to DPP, added SCOD reviewer role in the notification and close-out report, CIOH as approver of the Chair selection, established a preparation meeting 24 weeks before the design review meeting, clarified VCM/DCM, implemented workflow changes and clarifications, added management documentation and completed their SoA.

Table of Contents

1 Purpose

This document defines the procedure for **System Design Reviews (SDR)** performed **by the ITER Organization (IO)** on the ITER Systems design and introduces the simplified process for lower levels Design Reviews.

The Design Review Portal provides additional Guidelines and Templates to support this procedure.

Notice: In this document:

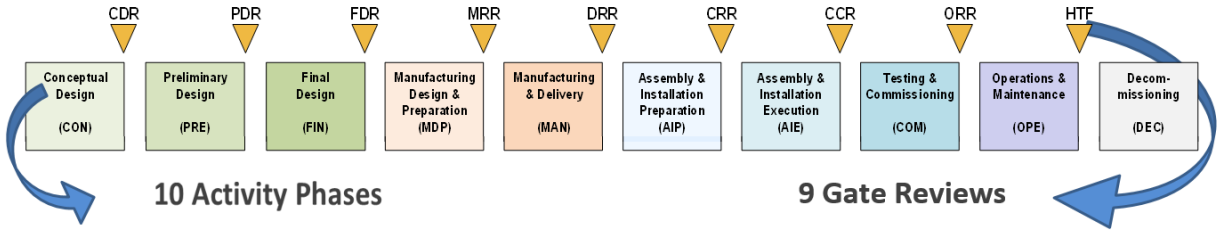
1. "Design Developer", "Design Coordinator" and "Design Approver" designate roles of **IO-CT staff**, unless otherwise defined (e.g. IO-DA Design Developer).
2. The terms "Domestic Agency" (IO-DA) and Procurement Arrangement (PA) can be respectively substituted by IO-CT Direct Contractor and IO-CT Direct Contract in case of design developed through IO-CT in-cash procurement.

2 Scope

This procedure applies to the review of the design outputs achieved at the end of the design activity phases (Conceptual Design, Preliminary Design and Final Design activity phases):

- Conceptual Design Review (CDR) at the completion of the Conceptual Design phase, to authorize the Design Developer to proceed to the Preliminary Design phase,
- Preliminary Design Review (PDR) during the design phase, if required, to authorize the Design Developer to proceed to the Final Design phase,
- Final Design Review (FDR) at the completion of the Final Design phase, to authorize the Design Developer to proceed to the Manufacturing Phase.

These are three of the phase gate reviews defined in the PMP [11].



CON	Conceptual Design
PRE	Preliminary Design
FIN	Final Design
MDP	Manufacturing Design & Preparation
MAN	Manufacturing & Delivery
AIP	Assembly & Installation Preparation
AIE	Assembly & Installation Execution
COM	Testing & Commissioning
OPE	Operation & Maintenance
DEC	Decommissioning

CDR	Conceptual Design Review
PDR	Preliminary Design Review
FDR	Final Design Review
MRR	Manufacturing Readiness Review
DRR	Delivery Readiness Review
CRR	Construction Readiness Review
CCR	Construction Completion Review
ORR	Operation Readiness Review
HTF	Handover to France

This procedure shall be applied for the review of the design of the ITER Systems, where Systems normally correspond to PBS level 1 nodes, but in some cases are defined at PBS level 2 nodes.

The procedure can also be applied for the review of the design of lower level Systems, Structures or Components (SSCs-typically PBS level 2 and below) for which the simplified workflow (Section 7.5) can be used.

The list of SDRs and applicable workflows are identified in the Design Review Plan **[3]** managed by CIO.

Note:

Because of the first of the kind nature of ITER, in some cases some aspects of the design are left to be defined after the FDR during the Manufacturing Design and Preparation Phase. In this case, the final review of this part of the design and the final verification that all the requirements are achieved shall be done at MRR where the Authorization To Proceed is given [10].

External design agencies (i.e. Domestic Agencies (DAs), IO Direct contractors or subcontractors) shall use this procedure or another SDR procedure compliant with the latest approved version of this procedure. In the latter case, the external design agency's procedure shall be accepted by IO-CIOH, and the IO-Design Approver should ensure that IO approves the Notification and Close-Out Report.

2.1 PICs and PIAs

When the SSC design includes Protection Important Components or/and involves Protection Important Activities, the design review conducted by the Nuclear Operator is a surveillance of the activity "*Definition and design-basis studies for systems and components including PIC components*" in agreement with of article 2.2.2, 2.5.1 and 2.5.2 of Order 7th February 2012 and it is part of a global Technical Check of the PIA associated to design development .

2.2 Extent of the review

The extent of the review depends on the stage of the design activities. It is responsibility of the Design Approver in charge of the structure/system/component (SSC) to be reviewed, in agreement with the CIOH, to define the scope and objectives of the SDR, the parts of the design which are out of scope and the relationship with other design reviews to ensure that the full scope is addressed. These objectives shall be stated in the SDR Notification.

2.3 Planning and Scheduling

The Design Reviews shall be executed in accordance to the yearly Design Review Plan [3] which lists the Design Reviews according to their features, shows their logical sequence and the link to the Project Milestones and phases:

- Level: Plant level, System level, Sub-system or below,
- Applicability: PBS scope and usage,
- Kind: CDR, PDR, FDR, MRR(*),
- DWS or Master Schedule Milestones they contribute to achieve,
- QA and Safety related attributes: PIC/PIA/SR, PE/NPE, QC,
- IO Unit or external organization in charge of the SDR.

(*) The MRR are listed in the Design Review Plan for completeness, the SDR procedure does not apply to the MRR itself.

3 Definitions and acronyms

Below is the list of definitions specific to this procedure. For Nuclear Safety Common definitions, see ITER_D_RLZXMV - Nuclear safety common definitions.

3.1 Definitions

Action Item:

Action/task to be completed to respond to any issue raised during the review using Chit form. An Action Item can be linked to several Chits and vice-versa.

Action Plan:

List of Action Items to resolve the Chits. This Plan shows for each Chit, the action to be done by the responsible for the action and the due date for completion approval.

Appealing process:

Process to be used by the Design Developer to ask the permission to downgrade a Chit category.

Chit:

Specific form [and by extension its contents] used to collect issues (requests for additional work, comments, proposals for improvement, etc.), to propose possible solutions, to review and approve them by the Chairman with support of panel members, to link them to Actions Plan and to record their closure.

Closed Session:

Timeslot at the end of **each day of the SDR Meeting** where the Panel summarises the activities and findings of the day and processes the Chits.

Close-Out Report:

Document proposing the closure of the SDR and providing (or not) authorization to proceed with the next design phase on the basis of evidence that all category 1 chits (if any) have been closed.

In addition the Close-Out Report refers to the current action plan showing remaining actions for not resolved category 2 chits (if any).

Close Out session:

Timeslot after the last closed session and before debriefing where the Panel makes the final decision on at minimum Chit 1 and their resolution actions in the draft Action Plan. The Design Developer, the Design Coordinator and Chit submitters may be invited.

Debriefing:

Open session at the end of the SDR meeting where the Panel presents conclusions of the review meeting to all the participants.

Design Plan:
Plan showing for a given system (or any system element) the list of technical and technical management documents to be issued during the design, by when and by whom, and their maturity (preliminary, consolidated, complete) at the end of a given design phase. It gives also specific attributes for document control and verification, and identifies design reviews documents.

Design Review Notification:
Formal announcement to the ITER Project of the organization of a System Design Review.

Design Review phase:
Period of time between the distribution of the Input Data Package and the approval of the Panel Report.

Design Review Portal:
A website controlling the overall SDR activity and which gives additional guidelines and templates (Notification, Agenda, Panel Report, Close-Out Report, etc.).

Document:
Any design/engineering data (Files, Documents, Schematics, CAD Model, Drawings, etc…).

External design agencies:
Design organizations external to IO-CT i.e. Domestic Agencies (IO-DAs), IO-CT Direct contractors or subcontractors.

Input Data Package:
List of documents with their version number, submitted as input to the SDR.

Panel Report:
Report produced by the Chair to summarise the outcome of the SDR Meeting and to provide recommendations how to proceed.

System [5]:
System designates the set of technical end-products at PBS level 1 or sometimes level 2 where it has been chosen to have a set of Technical Requirement Specifications: SRD, ICDs, CMMs. Currently about 90 systems are defined to cover the ITER Facility.

Transverse Functions [4]:
Transverse Function-ROs (TF-ROs) are responsible for the definition of the top-level requirements and the control of their development in the design. They will finally accept the achievement of a specific technical function during the acceptance of the ITER Plant.

3.2 Acronyms

Cat.	Category
CD/CDR	Conceptual Design/Conceptual Design Review
CEA	Commissariat à l'Energie Atomique
CIOH	Central Integration Office Head
DA	Domestic Agency
DIR	Design Integration Review
DCM	Design Compliance Matrix
DDD	Design Description Document
DPP	Document Production Plan
DR	Deviation Request
DWS	Detailed Working Schedule
FD/FDR	Final Design/ Final Design Review
I&C	Instrumentation and Control
ICD	Interface Control Document
IDM	ITER Document Management system
IO-CT	ITER Organization Central Team
IO-DA	ITER Organization Domestic Agency
IO-CT-SRO	Safety Responsible Officer
MRR	Manufacturing Readiness Review
NCR	Non Conformance Report
PA	Procurement Arrangement (between IO-CT and IO-DAs)
PCR	Project Change Request
PD/PDR	Preliminary Design/Preliminary Design Review
PFI	Physical and Functional Integration (Division)
PIA	Protection Important Activity
PIC	Protection Important Component
PIM	Project Issue Management
PR	Project Requirements document
QAA	Quality Assurance and Assessment
QARO	Quality Assurance Responsible Officer
RO	Responsible Officer
ROX	Return Of Experience
SD	Safety Department
SDP	System Design Process
SDR	System Design Review
SIRO	System Integration Responsible Officer
SLS	System Load Specification
SR	Safety Relevant (Component)
SSC	Structure, System and Component
TF	Transverse Function

UID	Unique Identifier
VCM	Verification Control Matrix

4 References

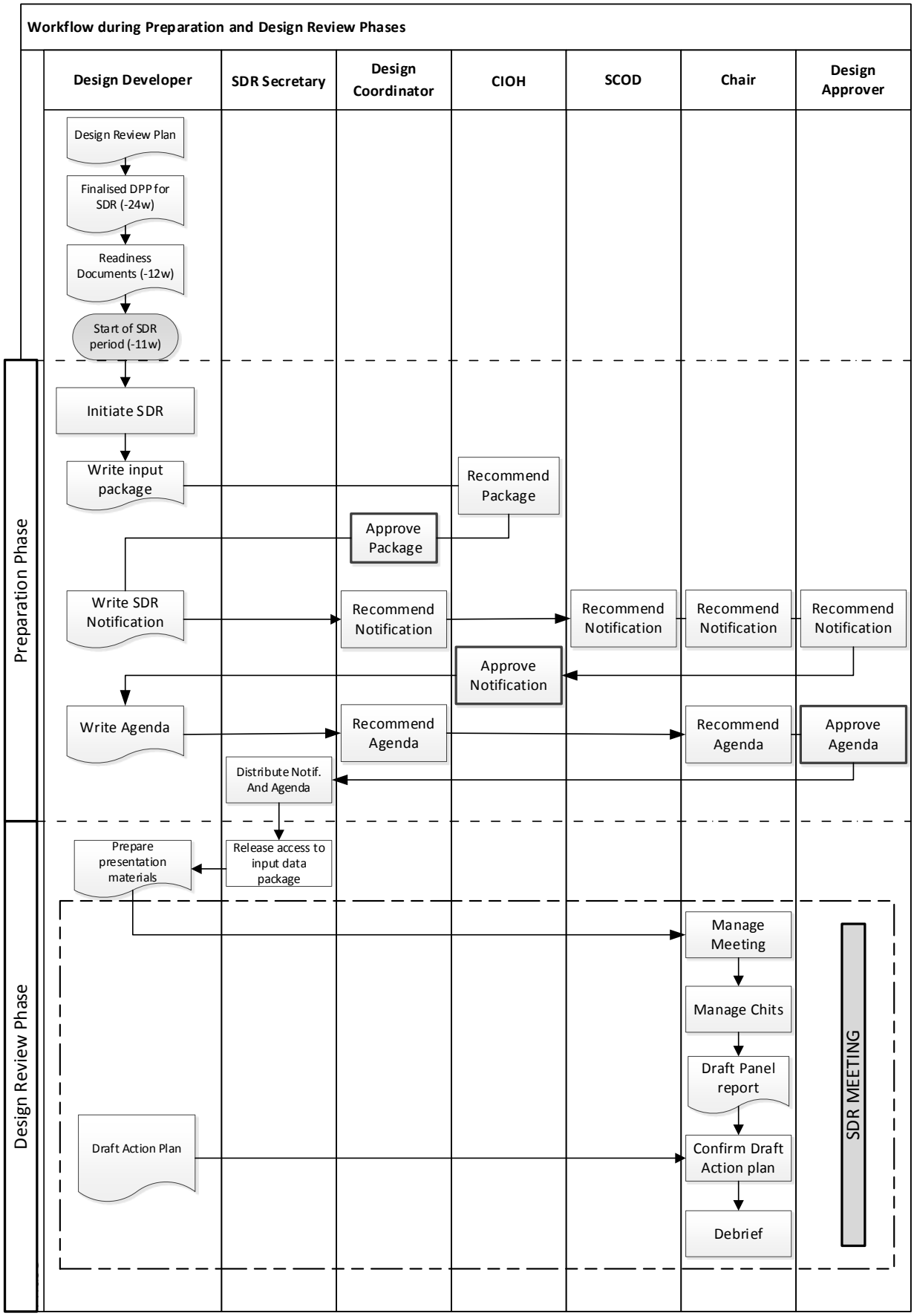
4.1 For compliance

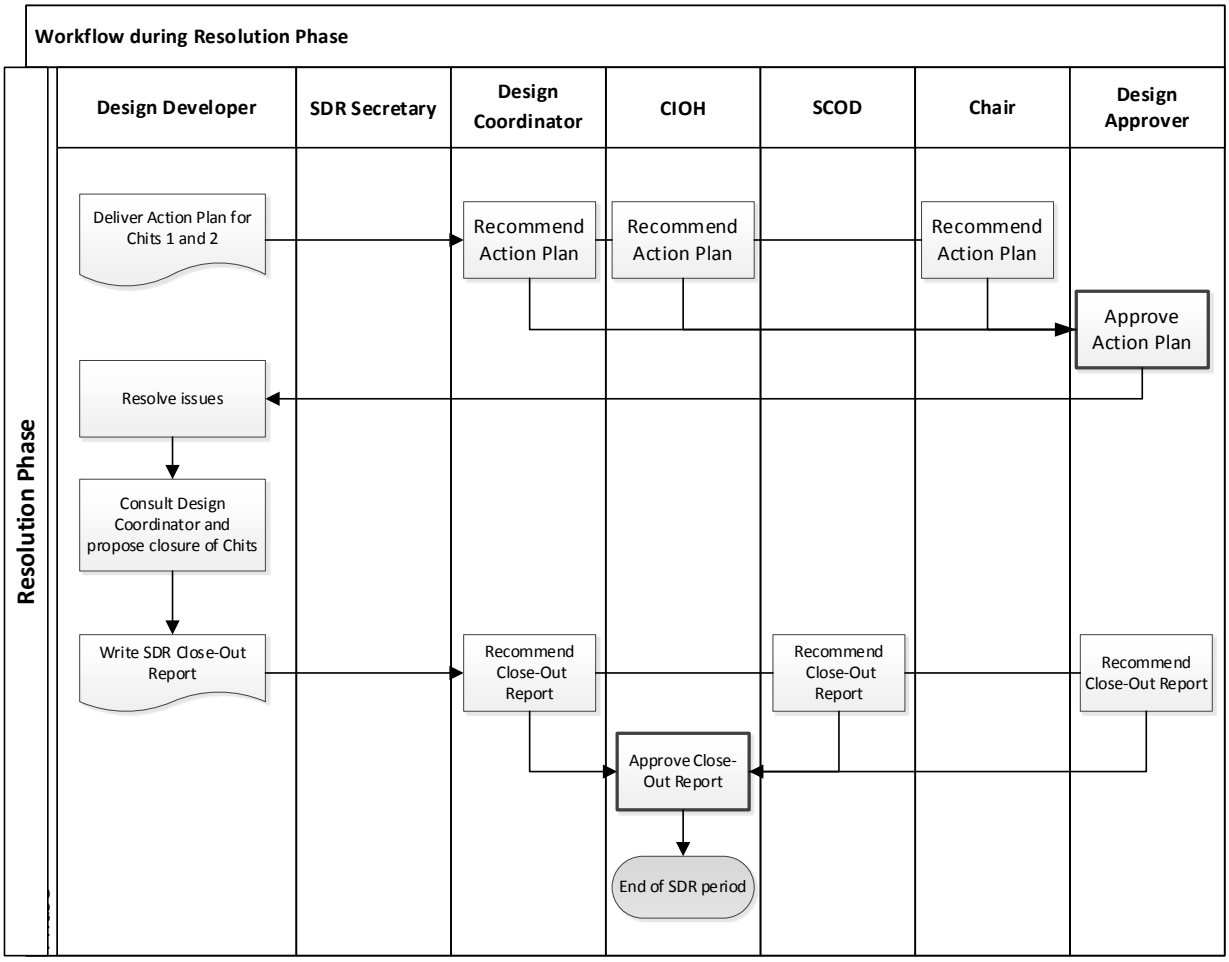
	IDM UID	Title
[1]	R3KD8C	Design Verification Procedure

4.2 For information

	IDM UID	Title
[2]	3CNWMT	Design Integration Review Procedure
[3]	Y4Q2RV	Design Review Plan for 2019 [example of yearly DR Plan]
[4]	SLPJRN	List of Transverse Functions Design Plans
[5]	4CK4MT	ITER System Design Process (SDP) Working Instruction
[6]	KXS5NV	Design Review Chairman List
[7]	U5TTNZ	Guidelines and Templates for SDR
[8]	T8FDWN	List of PBS Design Plans
[9]	27LH2V	Plant Control Design Handbook
[10]	44SZYP	Working Instruction for Manufacturing Readiness Review
[11]	2NCR3F	ITER Project Management Plan (PMP)

5 Flow chart


Workflow during Preparation and Design Review Phases
Design Developer
SDR Secretary
Design Coordinator
CIOH
SCOD
Chair
Design Approver
Preparation Phase
Design Review Phase
Design Review Plan
Finalised DPP for SDR (-24w)
Readiness Documents (-12w)
Start of SDR period (-11w)
Initiate SDR
Write input package
Recommend Package
Approve Package
Write SDR Notification
Recommend Notification
Recommend Notification
Recommend Notification
Recommend Notification
Approve Notification
Write Agenda
Recommend Agenda
Recommend Agenda
Approve Agenda
Distribute Notif. And Agenda
Prepare presentation materials
Release access to input data package
Manage Meeting
Manage Chits
Draft Panel report
Draft Action Plan
Confirm Draft Action plan
Debrief
SDR MEETING



6 Responsibilities

6.1 Design Developer

The Design Developer designates the technical person within the design agency (IO-CT or IO-DA) who is responsible for developing the design according to the System Design Process [5].

The Design Developer is the IO-CT System RO or the IO-CT Sub-system RO (also called PBS-RO) (normally a Section Leader) before the Procurement Arrangement, and the IO-DA-RO after (called IO-DA-Design Developer) under the monitoring of the IO-CT Design Coordinator.

In execution of his/her duties the Design Developer is supported by the Systems Integration Responsible Officer (SIRO) allocated to the PBS. During the design review preparation the SIRO will be in charge of the preparation of the documents for the propagation and verification of the requirements (Design compliance Matrix (DCM) and for the management of the interfaces with other systems (Interface Control Documents-ICD, Interface Sheets-IS and Interface Compliance Matrix-ICM). During the design reviews the SIRO will present the status of DCM and the status of the ICD and IS (at CDR and PDR) and the status of ICM (at FDR or MRR).

The Design Developer supports the Design Coordinator for the inputs to the review (preparation of administrative documents, availability of approved documents, presentations).

6.2 Design Coordinator

In the context of this procedure, the Design Coordinator (normally a Division Head) is the person responsible for the execution of the System design and the execution of the SDRs. This role shall not be confused with Design Coordinator (DECO) i.e a Design Office position for the management of CAD data.

He/she develops the design internally with the support of the IO-CT-Design Developer or makes the design developed externally by IO-DA-Design Developer through procurement arrangement. He/she remains accountable for the final performance of the system.

He/she shall manage his/her project i.e. the monitoring of the design development activities according to the agreed work plan (Design Plan [8], Document Production Plan and detailed working schedule-DWS) and procedures so that the design is delivered on time for the SDR.

He/she is responsible for the organization of the review i.e. making sure that things happen, and is supported by the Design Developer for the inputs to the review (notification, design documents, presentations, etc..).

He/she shall make sure that the Chair and the Secretary are trained.

He/she is responsible for the organization of the review of interfaces or a DIR before the SDR, for the definition and acceptance of corrective actions after review and for the acceptance of the design after the review according to approved procedures.

He/she shall ensure that all SDR records are properly managed and filed.

6.3 Design Approver

The Design Approver is the duly authorized person to approve the system design on behalf of his/her organization. Within the IO-CT, the system design Approver is the Department Head or delegate.

The Design Approver shall ensure that the system design is developed within the cost and schedule constraints, by competent people, with appropriate resources and according to approved processes (specifically System Design and Design Review Processes).

The Design Approver has to ensure that the Design Developer and Design Coordinator follow the SDR procedure. He/she approves the results of the review (Close-Out Report) after CIO Head and SCOD Head recommendations.

6.4 Central Integration Office Head (CIOH)

The CIO responsibility in the management of the Design are defined in the PMP [11].

For the SDR process the CIOH controls that the SDRs are executed according to the Design Review Plan [3] and in compliance with this Procedure by approving the design review Notification, and that the SDR is completed within the given time constraint and take necessary mitigation measures.

The CIOH recommends the input package for the design review and recommends the close-out report.

He/she ensures that documents dealing with the Safety performance of PIC, SR components and PIA are also authorized by the IO-CT-SRO according to the Design plan.

In case of appeal, (see 7.4.3) the CIOH coordinates the appealing process.

6.5 Design Review Manager

The Design Review (Process) Manager is the person responsible to support the CIOH and SDR process owner for the control of the SDR process.

He/she coordinates the preparation of the Design Review Plan, defines the SDR process and writes procedures, ensures the support to users (training, coaching) and the production of progress reports to the CIOH and Senior Management. The Design Review Manager administrates the SDR Portal and the SDR database and checks SDR documents from process viewpoint.

6.6 Design Review Secretary

The Design Review Secretary is proposed by the Design Developer and is appointed by the Design Approver to record the results of the meeting and enable the Chair maintain focus on the meeting. He/she should also provide logistics and review organization support to the IO-Design Developer.

The Secretary must be a technical qualified person with good knowledge of the system to be reviewed. A representative from the design team can be Secretary.

He/she shall make sure that relevant documents are distributed and accessible to the SDR stakeholders, that the stakeholders are informed and ensures that anybody can issue e-Chits.

6.7 Review Chairperson

The Review Chair is a technically and managerially qualified person not working on the system to be reviewed.

The Chairperson is appointed by the CIOH based on a proposal from the Design Approver from the list of qualified Chairs [6]). Other Chairs can be proposed providing their nomination is justified and agreed with the CIOH before issuing the Notification.

SDR Chair shall preferably be the same for all the reviews (CDR, PDR and FDR) to ensure continuity and effectiveness in the review process.

The Chair shall be **hierarchically independent** from the Design Approver for SDR on SSCs (or services) that are classified QC1 or PIC (i.e. the Chair shall belong to another Department than the Design Approver or be external to the IO-CT).

The Chair is a member of the review panel.

In the SDR the Chair has to:

- agree on the selection of Panel members;
- review and recommend the Notification and Agenda in preparation of the review;
- ensure that the SDR agenda is followed;
- chair the SDR meeting;
- review, merge, categorize and approve the chits;
- ensure that relevant issues from the meeting are recorded;

- ensure that actions and recommendations from earlier meetings have been satisfactorily addressed and closed, as appropriate;
- review and approve the record of meeting (Minutes of meeting);
- ensure that the meeting's minutes are issued to designated persons;
- issue the draft of the Panel Report;
- monitor the production of the draft Action Plan [7].

6.8 Review Panel

The Review Panel members shall be selected considering the type of SSC to be reviewed, its Quality Class and Safety Class, and the scope of the SDR.

The Panel should be composed of technical experts, who shall:

- have comparable experience and technical competence as the Design Developer;
- collectively have the breadth of expertise needed to competently review all aspects of the design;
- be independent from the IO-CT and DA-CT design team in charge;
- be informed about this procedure;
- follow strictly this procedure;
- be knowledgeable about ITER Design Integration requirements;
- support the Chair in identifying the issues and categorizing the Chits.

It is advisable that the composition of the Review Panel should remain the same throughout the progress of the project, in order to ensure a more efficient monitoring.

The role of the Panel members is to support the Chair for:

- the review of the Input Data Package in their domain of expertise;
- the assessment of the achieved design maturity for the considered design phase and of the remaining technical risks;
- the assessment of the soundness of the selected design option.

For the SDR process, the Chair shall assign review tasks to Panel members in their area of responsibility/expertise.

The Quality Assurance Responsible Officer (QARO) shall be one of the Review Panel members who is responsible for supporting and assessing the proper implementation of this procedure.

The table hereafter gives the typical composition of Review Panel:

Full List of Panel experts / representatives	**Participation**
Review Chair (Chairperson)	M
Nuclear Operator [SD]	M
IO/QA representative	M

IO/Health and Safety	M
IO/Integration [PFI]	M
IO/Assembly&Installation	O (M for FDR)
IO/Operations	M
IO/Main Interfacing System Representatives	O
IO/I&C	O
Other Technical Experts (1)	M
Concerned IO-DA (2)	M (4)
CEA expert (3)	O

Table 1: Composition of Review Panel and participation

Before issuing the Notification the Design Coordinator shall agree with the line management of the concerned people to confirm their participation.

"M" and "O" are attributes of the participation

M = *Mandatory participation*. The participation to the Panel is mandatory unless duly justified and agreed with the CIOH. Deviation to the Panel composition once agreed shall be justified in the Notification.

O = *Optional participation. The responsible of the relevant function is invited as optional participant but he/she decides if he/she wants to participate or not. Evidence of their choice to participate or not shall be included in the notification.*

The CIOH can request change of the Panel composition or attribute of the member. (e.g. change an Optional Panel member by a Mandatory Panel member and vice-versa) in the Notification.

(1) Design Approver may decide additional participation to the Review Panel. However it is advisable to limit additional participation to a minimum in order to reduce the cost.

(2) Prior to the PA, for systems to be procured in–kind, a representative of each IO-DA in charge of the procurement appointed by the affected IO-DA Head.

(3) As the result of an agreement between IO-CT and the Host Country, CEA experts are designated by the Agence ITER-France Director or representative to participate in the SDRs. The CEA experts or their representatives can make recommendations to IO-CT regarding decommissioning and raise issues whenever necessary. The decision to implement these recommendations or address these issues is IO-CT's responsibility through the transverse function "decommissioning".

Panel members should be made available for the full duration of the meeting, including close session and debriefing.

The Panel composition is proposed by the Design Developer in the SDR Notification. Technical Experts' area of expertise shall be detailed.

(4) Mandatory before PA, not to be considered after PA.

7 System Design Reviews (SDR) Process

7.1 SDR Objectives

System Design Reviews general objectives are defined in [1].

The general objectives of SDR is to ensure the suitability, adequacy and effectiveness of the system design to achieve the requirements. In particular, interfaces with other systems have to be established and approved before the start of the SDR.

For the three main SDRs, these objectives are:

Conceptual Design Review

A formal design review meeting conducted at an early stage of the design phase to assess that the requirements of the system are properly defined, verified, are complete and properly documented in the system requirement specification (SRD), the boundaries of the systems have been established, the overall design, construction and operation risks have been identified and are minimised in the selected concept.

Preliminary Design Review

A formal design review meeting conducted during the development phase of the design to monitor the progress of the design and to assure that the requirements are properly defined, verified and properly documented in the sub-system requirement specification (sub-SRD); the layout and interfaces have been fixed; a design concept that meets those requirements has been developed and supporting analyses and R&D are being carried out; outstanding design, construction and operation risks are identified and mitigated; and a firm basis exists to proceed with final (detailed) design.

Final Design Review

A formal design review meeting conducted to assure that the detailed design solution is complete, verified and properly documented in lower level requirement specifications, according to the planned maturity.

The detailed criteria for passing design gates for each design document at any PBS node level are given in the ITER System Design Process (SDP) Working Instruction [5] and associated Technical Document Families Cards (TDFCs).

SDRs are held at the end of the design phases (Conceptual, Preliminary and Final Design phases) to support the Acceptance/Approval of the design by the IO-CT-Design Approver.

The IO-Design Developer call for a SDR at the end of a given Design Phase, to assess, on the basis of a set of relevant documents, if the design is consistent, complete and mature enough to authorize proceeding to the next phase, specifically:

- to assess whether the proposed design output meets the design input requirements, that the design inputs requirements have been fully addressed, and that the design process was adequate for the complexity, quality and safety importance of the system/sub-system;
- to assess the evidence to support the verification of the design performance;
- to appraise the status of the design in terms of completeness and quality of the design output (drawings, models, documents and specifications);

- to discuss critical points and provide recommendations as required for achieving the design input requirements;
- to assess whether the proposed solution is the most cost and time effective solution to achieve the product requirements;
- to assess cost, risk and schedule impacts when required.

A SDR shall globally address design solutions, assess remaining technical risks and prioritize mitigation or corrective actions, but shall not focus on the review of individual documents.

A SDR finishes when the CIOH approves the SDR Close-Out Report.

7.2 SDR preliminary considerations

The Design Coordinator shall **identify the key SDRs** to be held in the Design Plan. Based on it, a yearly Design Review Plan is approved by the CIOH. SDRs scopes should be defined so that they cover the entire design of a given system (PBS level 1).

The SDR Plan gives the **official list of all SDRs to be organized and controlled by IO** using this procedure, their scopes (PBS elements involved in the review), and their kind (CDR, PDR, FDR, MRR).

SDRs shall be performed using the workflow **described in the Section 7.4,** but if the design scope concerns a PBS element at level 3 or below, or a simple sub-system, the Design Coordinator can propose a simplified SDR (See Section 7.5).

SDRs **shall be preferably held at IO** in Saint-Paul lez Durance (France) unless other arrangements are agreed by CIOH and the Design Approver through the SDR Notification. SDR meetings on externally developed designs shall be held with at least physical participation of the external Design Developer.

SDRs **shall use the** Design Review Portal for their management.

SDRs **shall use the** E-Chits application, which allows an automated tracking and processing of Chits.

The documents and forms to be used for the SDR are shown in Section 8.

The Design Review Manager shall define and maintain a list of qualified **SDR Chairpersons** and provide appropriate training to Chairpersons and secretaries. Training shall include SDR Chairmanship, Chit categorization and instruction to put aside all matters not directly connected with the boundaries defined for the SDRs.

Exemption

In some cases, a SDR can be exempted. For simple systems with limited interfaces, PDR can be merged with FDR, when all the conditions shown below are met simultaneously:

- The system to be reviewed is at low risk (i.e. using only already validated concepts and technologies);
- Preliminary Design and Final Design phases are carried out by the same Design Organization;
- No innovative components require qualification tests before FDR;

Each exemption shall be justified by the Design Coordinator in an Authorization to be issued together with the yearly Design Review Plan [3].

7.3 Readiness

SDRs are called at the end of a given design phase when the design has reached the maturity defined in the approved Design Plan, based on the ITER System Design Process (SDP) Working Instruction [5].

The Input Data Package shall be composed of the documents identified in the Design Plan [8] which shows the list of approved documents to be produced by the System-RO for the scope of the SDR and for a given design phase:

- IO-CT-documents shall be approved;
- IO-DA-documents submitted for IO-CT-Acceptance shall be IO-DA-approved and accepted by IO-CT before the review;
- IO-DA-documents submitted for IO-CT-Approval shall be IO-DA-approved and approved by IO-CT before the review.

This set of documents developed over the full design phase according to the Design Plan shall provide evidence that the design meets the requirements and the design maturity expected at the end of the design phase.

All interfacing System and Transverse Function ROs must be informed in due time, invited and allowed to participate at least via remote participation to the meetings.

Twenty four (24) weeks before the FDR meeting, the Design Developer shall organize a **preparation meeting** with CIO/DRM, PFI-RO, SIRO, O&M-RO and A&I-RO to:

- review the status of production of documents for the Design Review,
- identify any missing input data from interfacing system,
- check that the suitable A&I documents have been identified,
- assess if a separate constructability review is needed,
- review the plan for verification of critical documents,
- plan required corrective actions,
- and finalise the DPP.

Twelve (12) weeks before the SDR meeting, the Design Developer shall prepare the documentation for the **assessment of the SDR readiness** and submit it to the Design Coordinator, the Design Approver and CIOH.

The SDR readiness documentation shall include:

- review all **action items and Chits** coming from former SDRs, and status report;
- **Project Change Requests** (PCR) resolution status report showing which PCRs have been implemented in the Design to be reviewed;
- **Interfaces ICD/IS** status report including status of actions coming from the recent Review of Interfaces;
- Update of the Design Compliance Matrix;
- **draft SDR Agenda**, which shall include the following mandatory items:
  - the date, time and venue of the meeting;
  - the scope and objectives for the SDR meeting;
  - link to the **SDR Input Data Package** submitted to the review;
  - presentation of e-Chit application (secretary);
  - Report on Chit 1 and corresponding approved actions, and implementation from former SDRs; including Chit 2 resolution status from former SDRs;
  - Report on Deviation Requests (DR) and Non-Conformities on the reviewed PBS element;
  - Report on PCR (including any change to the input requirements);
  - Report on IS development against ICD scheduled steps, for each Interfacing System;
  - From the DCM, a report on the critical points and proposed solutions;
  - Sufficient time for the various SDR activities (presentations, closed sessions including adequate time in the close-out session for the drafting of the SDR Panel Report and Action Plan, debriefing…).

See SDR agenda template in [7].

- At FDR:
  - A report giving evidence that all the qualification tests on prototypes were successfully completed, and
  - The ICM giving evidence that the Interface requirements are fully implemented in the design documents.
  - When required, the result of the constructability review held in connection with the SDR.

Based on the above Reports, CIOH gives the authorization to proceed to the SDR through the Notification.

7.4 SDR Workflow

7.4.1 Preparation phase

1. The Design Review meeting is initiated by the Design Developer (**11 weeks before the SDR meeting**), in accordance with the approved Design Review Plan [3] and after a positive assessment by the Design Coordinator who may use the Design Review Checklists (see template in [7]) as a guideline.

The SIRO shall contact PFI-Head to organize **a review of interfaces** (or a Design Integration Review for systems with complex interfaces). This includes a review and validation of functional and physical interfaces [2] and shall be done **6 weeks minimum before SDR meeting.**

2. **10 weeks before the SDR meeting**, the SDR Secretary submits **the draft SDR Notification** (see template in [7]) for Approval by CIOH. The SDR Notification includes objectives, scope and organization of the SDR, next stage of development, proposed list of participants (Panel members and people to be informed (Division Heads of the Panel members) including all Interfacing System ROs and all Transverse Function ROs (see TF-ROs in [4]), and provides the link to the list of Input Data Package documents, the Agenda and the list of unresolved Chits. The Notification shall include the evidence of the confirmation by the Panel members of their attendance to the review (whether they are mandatory or optional members). It is the responsibility of the Panel member to validate their attendance with their line manager before confirming the invitation.

SDR Input Data Package is a list of documents which contains documents developed during the phase and documents linked to the control of the Design Review:

- Report to be prepared by the SIRO on **Project Change Requests** (PCR) resolution showing which PCRs from the former design review (or the beginning of the phase) are impacting the design, which ones have been implemented in the design to be reviewed (i.e. closed PCR); and which ones have not yet been implemented (i.e. open PCR) with justification and risk assessment.

  The PCR report shall be approved by CIOH.
- Report by SIRO on **Action Items and Chits** that were not closed at the last Design Review Close-Out Report. A justification and risk assessment shall be developed when Chits are not closed.

  The report shall be approved by CIOH.
- Report on Deviation Request (**DR) or Non-Conformance Reports (NCR)** resolution showing which **DR/NCRs** from the former SDR (or the beginning of the phase) are impacting the design, which ones have been implemented in the design to be reviewed (i.e. closed DR and NCR); and which ones have not yet been implemented (i.e. open DR and NCR) with justification and risk assessment.
  The report shall be approved by CIOH.
- Report by SIRO on **Interfaces ICD/IS** development showing evolutions from the last design review, and including status of actions coming from the recent Review of Interfaces (all these actions shall be closed and IS shall be approved according to the ICD schedule). At FDR the full ICM shall be provided to provide evidence that the interface requirements are implemented in the design documents and specifications. Any discrepancy shall have justification and risk assessment.

  The interface report showing readiness for Design Review shall be approved by PFI-Head.

- SRD shall be updated and approved (with evidence of full propagation from PR) for all the changes of requirements approved at the date of the design review.
- Update of the Design Compliance Matrix; taking into account the SRD update.

See reference [7] for the SDR Input Data Package template.

3. The Design Approver verifies the readiness of documentation included in the Notification, CIOH appoints the Chair and in consultation with the Chair confirms the members of the Review Panel. Then CIOH **approves the SDR Notification**.

   If the Design Approver or CIOH judges that the progress and the maturity of mandatory documentation are not adequate for the concerned SDR to take place, then the SDR meeting should be postponed.

   In particular, unless otherwise agreed with CIOH in concurrence with SD:

   1. NCRs on PIC & SR SSCs shall be closed before any SDR on them;
   2. PCR/DR impacting the system or its interfaces shall be closed before the FDR or at the latest before the Build-to-Print design is Authorized To Proceed for Construction (i.e. when the FDR Close-Out Report is approved).

4. The SDR Secretary sends the final Notification and Agenda to the participants (via Microsoft Outlook or equivalent) and shall formally check each Panel members' or their delegates' availability and agreement to participate. He/she gives read access to the Input Data Package in IDM (in particular for external members (CEA, DA, etc. and restricted access documents). This shall be done **not later than 2 weeks before the SDR meeting.**

   Change to the list and contents of documents of the Input Data Package shall not be allowed from the moment the Input Data Package is distributed for review until the approval of the Panel Report.

5. The Design Developer prepares presentation materials and can involve other persons involved in the design execution activities.

   The Design Developer shall present critical aspects of his/her design, supported by other presenters (e.g. DA-Design Developer) with specific emphasis on issues and uncertainties identified from the Design Compliance Matrix (DCM).

   Input data package shall identify the approved configuration, i.e. the documents to be placed under configuration control after the SDR close-out.

7.4.2 Design Review phase

Design review phase starts when the Input Data Package is distributed for review.

6. (**Date of the SDR Meeting**): The Chair shall manage the meeting, moderate the discussions ensuring that the focus stays on the design assessment and that all participants can provide their inputs and try to reach consensus in the review team in case of different opinions. If consensus cannot be reached the Chair reports minority as

well as majority view(s) in the Panel Report, however final decision is left to the Chair but for Safety Chits.

7. All Chits issued during the SDR shall be submitted in using the E-Chit application that shall be opened for Chit submission when the Input Data Package is delivered (i.e. 2 weeks before the SDR meeting) and the Chit submission shall be closed before the last closed session.
   A Chit shall clearly define an issue and should be quantitative, directly applicable to the scope of the review and should propose possible corrective actions including criteria for Chit closure.

8. When the Chit affects integration aspects or design work of many systems the Secretary shall formally send the Chit to the CIOH for resolution in the appropriate forum (PIM Project Issue Management). The chit can be closed when the PIM issue is closed.

9. When a Chit is not relevant to the reviewed system, but may affect another system, the Secretary shall normally send the Chit to the CIOH for resolution in the appropriate forum and close the Chit.

10. The Chair in consultation with the Review Panel **shall drop** a Chit if one of the following situations arises:
    - The Chit is in contrast with the Project Requirement and/or with the System Requirement Document;
    - The Chit requires information already provided in the SDR input data package;
    - The Chit requires a higher level of maturity of a document, which is not consistent with the recommended maturities specified in the Design Plan;
    - The Chit is not within the scope of the SDR;
    - The Chit has already been addressed.

11. The Chair in consultation with the Review Panel **shall merge and categorize Chits** according to Table 2 below. The Chair shall read each Chit and the corrective action proposed and if needed rephrase them with the Chit issuer for a better understanding.

    The Chair shall **prepare and issue a draft of the SDR Panel Report before the end of the meeting**. To that aim, adequate time and a dedicated closed session shall be included in the SDR Agenda at the end of each day. The SDR Panel Report shall contain a summary of the outcome of the SDR, the list of Chits 1, 2 and 3, any deviation from the Agenda and Notification (on the scope and participants in particular), and the link to the draft Action Plan. When required, the Chair is encouraged to invite the originators of the Chits to explain their Chits to the Design Developer and the Design Coordinator for clarification purpose, to finalize the categorization of the Chits and to ensure that the

Chits are assigned to the proper organization. The Panel Report agreed with Panel members shall be issued within 1 week after the SDR meeting.

12. The Nuclear Operator representative (IO-CT-SRO) decision prevails on the Chair in case of disagreement on the categorization or the dropping of Safety Chits.

Chit Category	Description
Category 1	They shall address only major design issues, such as lack of verification evidence (e.g. unsuccessful prototype results) that the Design solution can meet a specified requirement. They shall be resolved for getting the Authorization to Proceed for next development phase (1) (Close-Out Report).
Category 2	They shall address design issues of enough significance to require Action Plan and formal resolution tracking. Their resolution is not required for getting the Authorization to Proceed for next development phase (1) (Close-Out report). All unresolved Cat. 2 Chits shall be assessed at the next SDR and resolved before FDR Close-Out Report unless there is a specific authorization from the CIOH.
Category 3	Recorded in the Panel Report but not requiring formal tracking and action.

Table 2 Chit categorization

(1) Next development phase is PD phase for CDR, FD phase for PDR, manufacturing or construction phase for FDR.

13. **Close-out session**

A Close-out session shall be planned with the Design Developer and Design Coordinator to review and agree on the corrective actions (for Chit 1 and Safety Chits at least). A draft Action Plan [7] shall be delivered.

Decision taken on Safety Chits shall be recommended by the IO-CT SRO.

14. **Debriefing:**

The Chair shall present to all the participants the results of the meeting during the SDR debriefing.

7.4.3 Resolution phase

The resolution phase starts soon after the SDR meeting and finishes with the Authorization to Proceed (called Design Approval in the DWS) to the next Design phase. It is recommended to schedule a duration of **minimum 12 weeks** for this phase.

15. The Design Developer, in consultation with the Design Coordinator, proposes to the Design Approver, after proper review, **the closure of Chits** for which a justification can be provided without further actions.

16. **Appealing process:** In exceptional cases, the Design Developer, in consultation with the Design Coordinator and the Design Approver, may propose together with a justification and action plan, to change the categorization of a Chit and/or to close the SDR (Close-Out Report issuance) without having resolved the required Chits (e.g Chit 1 and Chit 2 for closing the FDR). In the latter case, an Action Plan to resolve these Chits must also be presented. This proposal is made to the **CIOH** in concurrence with SD for Safety Chits (after recommendation by IO-CT SRO). The decision together with the justification and Action Plan (for Chits which are resolved after the SDR closure) must be recorded in the Close-Out Report.

17. **Within 2 weeks after the SDR meeting**, the Design Developer shall finalise and deliver the Action Plan prepared during the SDR, consistent with budget and schedule, including **actions items description** in the ITER Actions Database (or other tool accepted by CIO/DRM) for at least the resolution of Chits 1 (Chit 2 for FDR) and Safety Chits.

    The Action Plan to resolve the chits shall identify due dates, criteria for closure of the issue and the competent stakeholder(s) for reviewing the action completion.
    The content of the actions involving Safety Chits must be uploaded in IDM and recommended by the IO-CT-SRO before proceeding to their resolution.

    The Action Plan shall also contain, as action, the writing of the Close-Out Report with a due date for the upload in IDM and a due date for approval.

    The final detailed Action Plan shall be recommended by CIOH and approved by the Design Approver within **2 weeks**.

18. The Design Coordinator has to ensure that the persons assigned to the actions execute the Action Plan timely and that the Chits are closed with evidence of the work done and a reference to the updated documents.

19. **3 weeks before** the design approval milestone, the Design Developer shall prepare the **SDR Close-Out Report**; this SDR Close-Out Report shall:
    - Provide evidence that all Cat. 1 Chits (plus Cat. 2 Chits if FDR) have been resolved and the Action Plan has been executed;
    - propose the closure of the SDR;
    - include the list of design documents reviewed at the SDR (and updated after Chits resolution), with their approved or accepted versions which are the basis for the execution of the next phase;
    - Changes to the Input Data Package documents due to Chit resolution are explained and traced in the Close-Out Report;
    - Other approved changes not resulting from SDR shall be identified and explained in the Close-Out Report;

- describe the status of remaining Chits and action plans for their resolution during the next design phase.

The Design Developer requests IO-CT-SRO recommendation for PIC/SR SSCs.

20. The Design Approver approves the SDR Close-Out Report after CIOH and SCOD (and IO-CT-SRO for PIC and SR SSCs) recommendations. This Approval acknowledges the completion of the SDR and gives the Authorization to Proceed to the next development phase. The final versions of documents accepted as a result of the SDR and to be considered applicable for the next phase are notified by the Design Developer to the Configuration Manager and placed under configuration control as appropriate.

7.5 Simplified SDR workflow

Design reviews on lower level SSCs can use the simplified SDR which relaxes requirements on the organization and execution of the SDR: review and approval of key documents (Notification and Close-Out report), reduction of the number of participants, duration of the review steps, content of the Agenda and duration of the meeting itself. However requirements concerning the management documents (see Sections 8 and 9) and management of the design documents after the review remain the same.

The SDRs that follow the simplified process are identified in the **Design Review Plan**.

The execution should involve remote participation instead of in person participation, organization of a closed session and debriefing meeting at the end of the review period.

Each simplified SDR shall be justified by the Design Coordinator in an Authorization [7] to be issued together with the yearly Design Review Plan [3].

In the Notification for the simplified SDR, the Design Developer indicates (see Table 1 in Section 6.8) for the full list of Panel members and for each Panel member if he/she wants them to attend or not. He/she includes also a justification when a Panel member is not invited. The Notification shall be accepted by the full list of Panel members (see guidelines [7]).

The selection of the Chair of a simplified SDR is approved by the Design Approver in the Notification.

8 Forms and Templates

Note: for each document, the author shall use the latest approved version of the related template (see [7]).

Document (IO documents)	Document Type	Author	Reviewers (1)	Approver (2)	Distribution for Information	Templates IDM UID
Reports supporting SDR readiness (Section 7.4.1)	[D]-Report	SIRO	Design Developer	CIOH or PFIH if delegated		
SDR Notification (includes links to data package)	[D]-Authorizations and Permits	Design Developer	Design Approver SCOD PFI Head SIRO Design Review Manager Design Coordinator Chair	CIOH	All the IO-CT Panel members and their line managers. Transverse Function ROs [4]	[D2D57E]]
Notification for Simplified SDR (Section 7.5)	[D]-Authorizations and Permits	Design Developer	SIRO Design Review Manager Design Coordinator	Design Approver		[D2D57E]]
Meeting Agenda	[D]-Agenda	Design Developer	Chair Design Review Manager Design Coordinator	Design Approver		[CDR-D23MNT] [PDR-D275WB] [FDR-D27KD8]
Input Data Package	[D]-List	Design Developer	Design Review Manager CIOH (3)	Design Coordinator	Transverse Functions-ROs [4]	
Presentations	[D]-Presentations	Presenter	Design Developer	Design Coordinator		
Chit (5) definition	[E]-Chit Forms for design	Anyone	Panel members (6)	Chair		

Document (IO documents)	Document Type	Author	Reviewers (1)	Approver (2)	Distribution for Information	Templates IDM UID
	reviews					
Chit resolution			Chit emitter Chair	Design Coordinator		
Minutes of SDR Meeting	[D]-Meeting minutes	Secretary	Design Developer	Chair		[D2FNX7]
Panel Report (incl. list of Chits)	[D]-Report	Chair	SCOD PFI-Head Panel members Design Review Manager Design Coordinator	Design Approver	Transverse Functions-ROs [4]	[D2FJNJ]
Action Plan	[D]-Plan	Design Developer	IO-CT-SRO of the system for PIC/SR (4) Design Coordinator Chair CIOH (3)	Design Approver	Transverse Functions-ROs [4]	[RFM3N3]
Close-Out Report (6)	[D]-Report	Design Developer	SCOD CIOH (3) SIRO Design Review Manager Design Coordinator IO-CT-SRO for PIC/SR Chair	Design Approver	All Panel members	[D2DHAT]
Close-out report for simplified SDR (Section 7.5)	[D]-Report	Design Developer	CIOH (3) Design Review Manager	Design Approver		[D2DHAT]

Document (IO documents)	Document Type	Author	Reviewers (1)	Approver (2)	Distribution for Information	Templates IDM UID
			Design Coordinator IO-CT-SRO for PIC/SR Chair			

Table 3: SDR Management Documents

(1) Other reviewers are possible.

(2) Or delegated person.

(3) When CIOH is reviewer his/her recommendation is mandatory for further Approval. He/she acts as lead Verifier, i.e. distribute for review to relevant Transverse Function ROs.

(4) IO-CT-SRO: Safety Responsible Officer. If the review is not available in the action item application, the description of the action is reviewed in IDM before being submitted.

For PIC/SR components, the IO-CT-SRO recommendation is mandatory prior to further Approval.

(5) Chit is closed upon completion of related actions defined in the action plan

(6) Chits can be approved by the Chairman one day after the chit submission even if the Panel members have not recommended.

9 Records

Design Coordinator is responsible for ensuring that all SDR management documents (see Section 8) and updated System design documents presented to the SDR are recorded. When the SDR is finished, the Design Coordinator ensures in collaboration with the Configuration Manager that these documents are incorporated into the configuration baseline according to the configuration management procedures.

The retention period of all these documents shall be the duration of the ITER Project.

Appendix 1: Input Data Package

The DPP shall identify which documents will be part of the SDR Input Data Package and justify when documents will not be delivered.

The key documents for the SDR are:

- SRD and SLS of the system/sub-system/materiel to be reviewed, the DDD of the system/sub-system/materiel as the umbrella document giving a summary of what has been achieved in each domain and identifying supporting documents;
- DCM/VCM of the system/sub-system/materiel as document showing propagation/not propagation of requirements into the design;
- Report on PCR;
- Report on action items and Chits from previous SDR;
- Report on DR and NCR;
- Report on Interfaces development from the review of Interfaces or DIR.

The DPP gives the detailed list of documents for each document type.

Document Types	Design Phases		
	Conceptual	**Preliminary**	**Final**
Requirements			
System Requirements Document	Complete	Minimal update	
Interface Control Documents (*)	Complete		
Interface Sheet **(*)**	Preliminary	Consolidated	Complete (1)
Configuration Management Model Mock-Up **(*)**	Preliminary	Consolidated	Complete
Description			
System Design Description	Preliminary	Consolidated	Complete
System Functional Analysis	Preliminary	Complete	Minimal update
System Load Specifications	Preliminary	Complete	
System Detailed Performance Definition	If useful	Preliminary	Complete
Process Flow Diagram	Complete	Minimal update	
Detailed Diagrams (P&ID, SLD, routing/cabling)		Preliminary	Complete
Other Control and Instrumentation Documents, see list in PCDH [9]		Preliminary	Complete
Mechanical Engineering Model & Drawings **(*)**	Preliminary	Consolidated (2)	Complete (2)
Bill of Material and Component Classification	Preliminary	Consolidated	Complete
Component Technical Specifications		Preliminary	Complete
Operation and Maintenance			
System Integrated Logistics Support Plan		Preliminary	Complete
Operation Plan		Preliminary	Complete
Maintenance Plan		Preliminary	Complete
Periodic Test and Inspections Plans		Preliminary	Complete
Justification (Justification Folder-DJF)			
Design Compliance Matrix (DCM)	Preliminary	Consolidated	Complete
Design Reviews and Recommendations **(*)**	At each stage		

Document Types	Design Phases		
	Conceptual	Preliminary	Final
Design Justification Plan	Preliminary	Complete	Minimal update
Engineering Analysis Reports and Calculation Notes	At any stage of the design to support justification		
Previous ROX and R&D	Complete		
Factory Qualification Test Plan		Preliminary	Complete
Qualification Summary Report for PIC Components		Preliminary	Complete
DJF- Tests & Commissioning			
On Site Assembly Plan	Preliminary	Complete	Minimal update
On Site Testing and Commissioning Plan	Preliminary	Complete	Minimal update
Decommissioning Plan		Preliminary	Complete
Design Management			
Cost and Schedule – Risks Assessment	At each stage		
Work Plan	At each stage		

(*) Documents generally provided as input for the Design Integration Review

Table 4: Maturity of System Design Documents at the end of the Design Phases

(1) Complete as far as possible depending on the maturity of the interfacing system,
(2) 3D CATIA models in the “In-Check” status”