



# HL-LHC Safety Assessment Process

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HL-LHC Collaboration Meeting, Madrid, 13. – 16. 11. 2017

# CERN Safety Policy

- Quote from the 2016 edition of the CERN Safety Policy
  - “The Organization is committed to ensure a continuous improvement of Safety based on:
    - [...]
    - a Safety management system
    - [...]”
- The Safety Management System is embodied in the creation and maintenance of “Safety Files”

# Safety Files

## EDMS 1177755

- CERN Safety Files exist for different facilities:  
Facilities subject to safety files are accelerator facilities (accelerator and storage rings, experiments and all surrounding infrastructures), technical infrastructures, workshops and laboratories.

	Safety File definition and contents
Beam facilities	Quality Management Procedure - Safety Files Management
Other facilities	Approach defined on department level
Equipment	Contents defined in CERN Safety regulations and instructions
Projects	Defined by the HSE unit in the “Launch Safety Agreement”, based on a hazard assessment

# Safety organisation for Projects

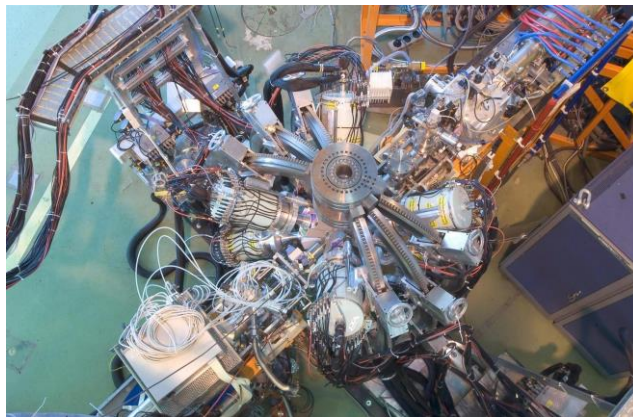
Safety Officer  
(appointed by Project,  
by default the  
Technical Coordinator)



Safety Correspondent  
(appointed by HSE unit)

- Identify hazards of the project
- Safety correspondent edits the “Launch Safety Agreement”
  - Listing of applicable Safety rules (CERN rules, EU directives, host state laws, International Standards)
  - Definition of the minimum content constituting the “Safety File”

# LSA Process



- Process practice-proven for small to moderate size projects (experiment, building, equipment ...)
  - Assists projects without Safety professionals to meet requirements

# LSA Process

- Drawbacks for large projects:
  - In principle, only one LSA for the whole project
  - Rules quoted in LSA are essentially focussed on safety conformity issues
  - Does not take account of experience of Safety professionals
  - Heavy workload on the HSE unit to prepare the LSA and check the resulting Safety Documentation

# New Safety Assessment Process

- In collaboration with the HSE unit, definition of a new Safety assessment process for HL-LHC:
  - Project breakdown in Subsystems
  - Hazard assessment
  - Identify “Standard Best Practice” (SBP)
  - Perform Risk Assessment where SBP not available
  - Safety clearance by HSE unit for subsystems with “major Safety implications” (mSi)
  - Commission and Operate

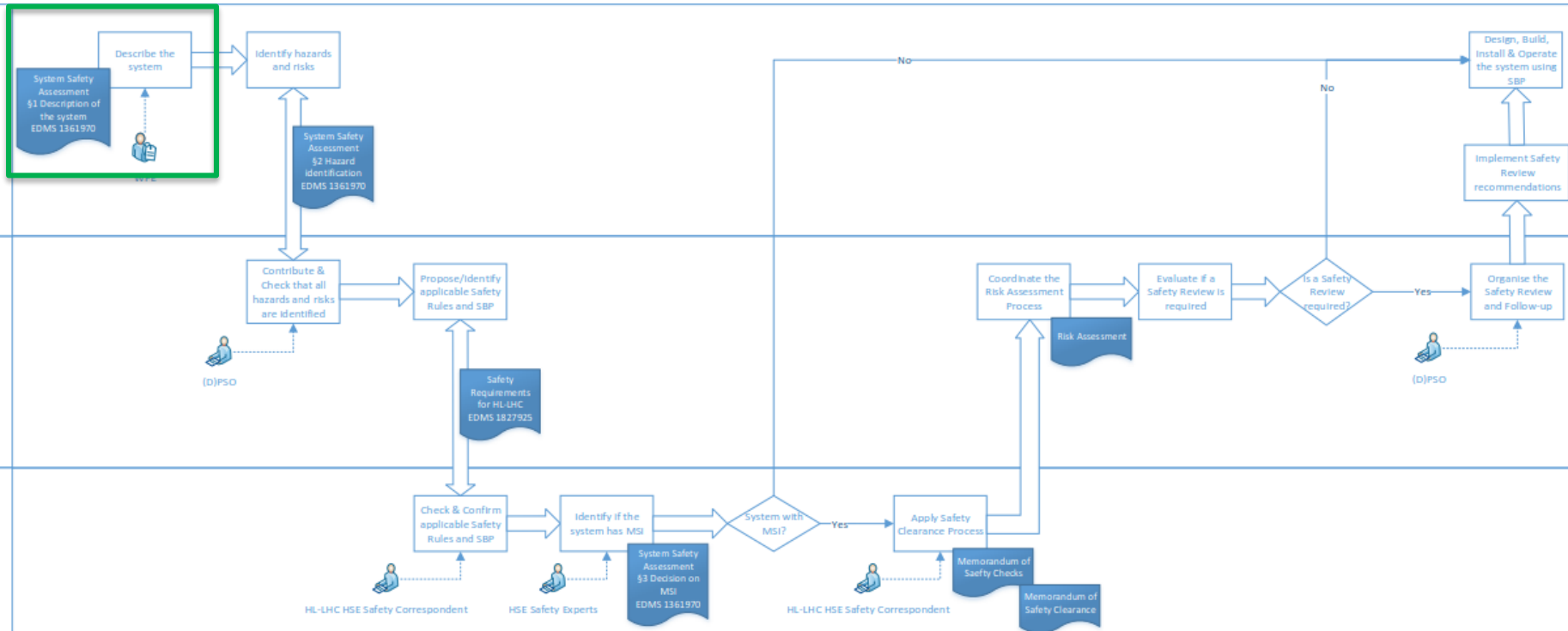
# Subsystems to be Assessed

HAZARD IDENTIFICATION AND RISK ASSESSMENT PROCESS AT SYSTEM LEVEL (EDMS 1827925)

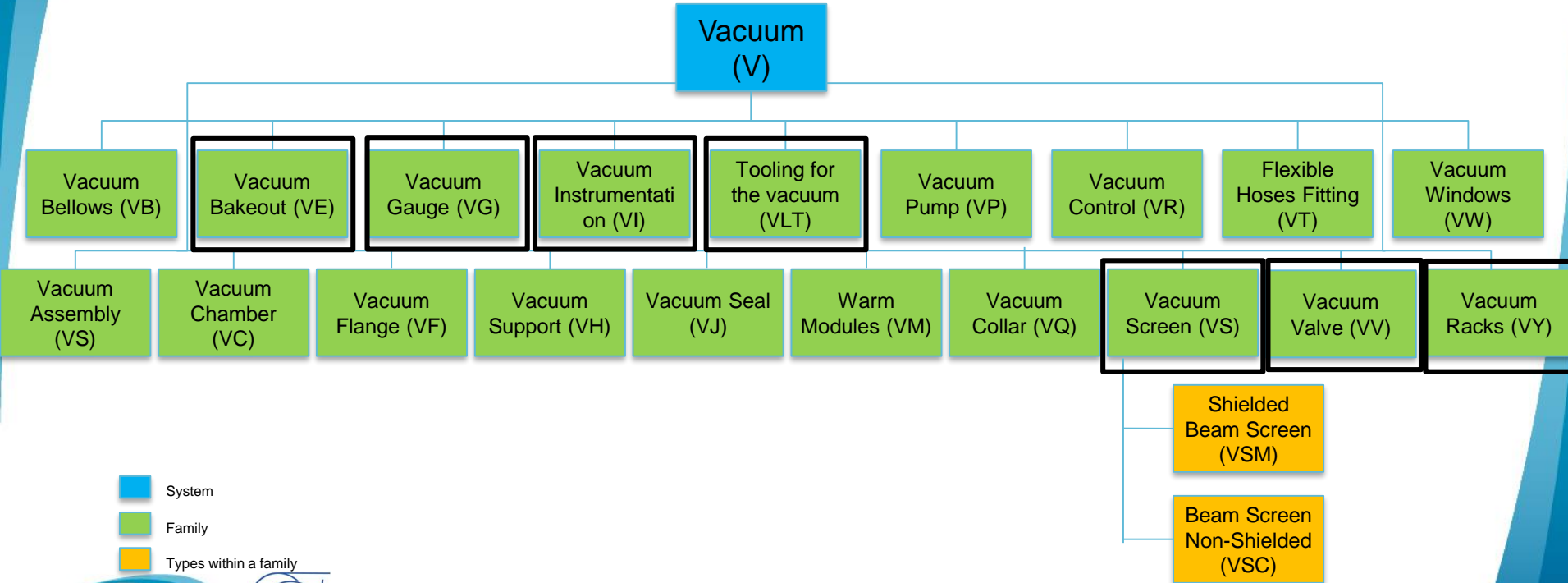
HL-LHC WORKPACKAGE

HL-LHC Safety Officers

HSE Unit



# Subsystems to be Assessed



System



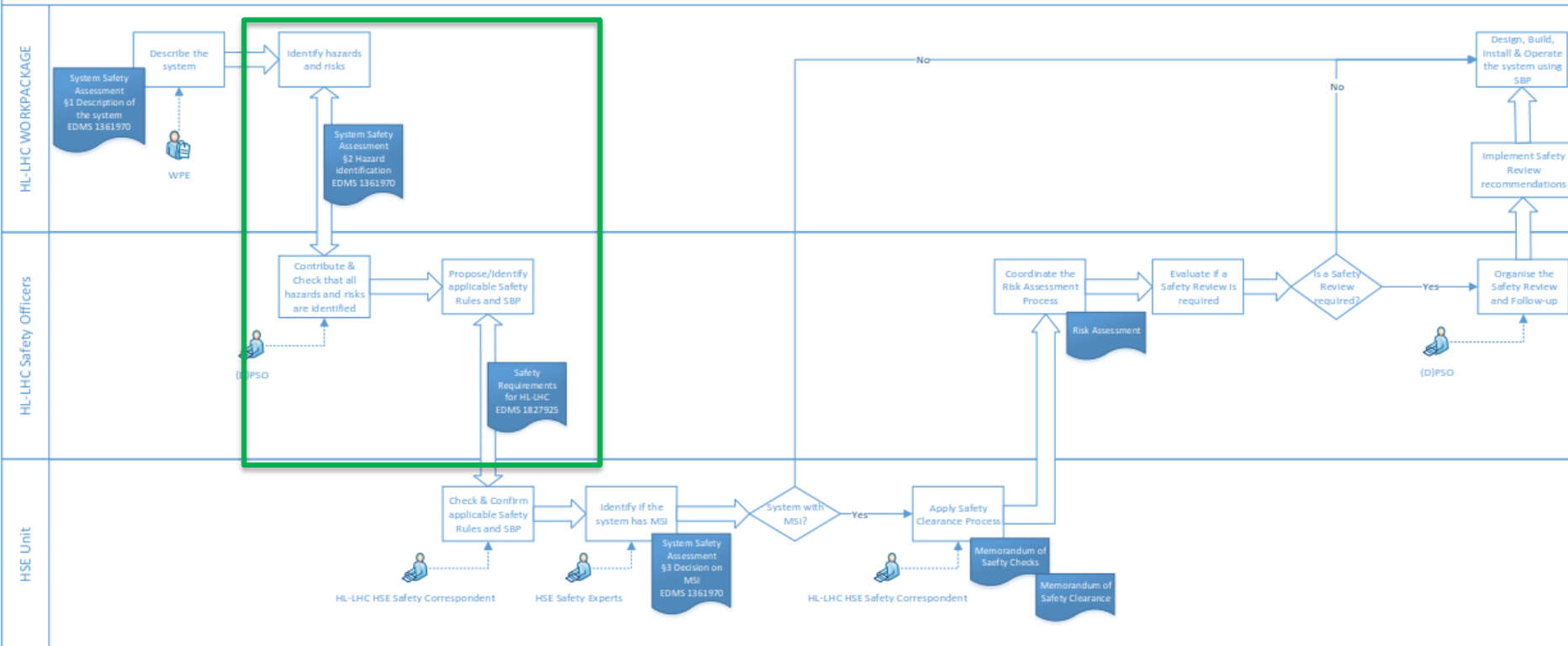
Family



Types within a family

# Hazard Identification and Standard Best Practice

HAZARD IDENTIFICATION AND RISK ASSESSMENT PROCESS AT SYSTEM LEVEL (EDMS 1827925)



# Hazard Identification

- Use of an accelerator-specific hazard list
  - Based on Swiss “Industry Standard” from occupational accident insurance SUVA
  - Complemented with
    - hazards for and from the environment
    - more details in accelerator-specific areas (e.g. ionising radiation)
- Identification of hazards between Work Package specialists and Project Safety Officers

# Standard Best Practice

- “Standard Best Practice” can be applied to an identified hazard without making a risk assessment
- Example: safety conformity requirements
- First source of SBP is the catalogue in the LSA
- Other sources are
  - European directives and standards
  - Best practice from occupational safety organisms
  - Return of experience

# Hazard Identification



HSE  
Occupational Health & Safety  
and Environmental Protection Unit

EDMS NO.	REV.	VALIDITY
	0.1	DRAFT
REFERENCE : HL-LHC SAFETY		

Family	Hazard	Details	SBP
	Naturally occurring radioactive materials		
	Particle beam		
	Radioactive aerosols		
	Radioactive surface contamination		
	Radioactive test sources		
	X-ray (parasitic)		
	X-ray generators		
<b>B3</b>	<b>Radiation, non-ionising</b>		
	Laser		5.8.3.
	Microwaves		5.8.1.
	Radiofrequency		5.8.2.
	UV		
<b>B4</b>	<b>Noxious Substances</b>		<b>5.9</b>
	Dust, particles (non-radioactive)		
	Substance, biologically harmful		5.9.1.
	Substance, carcinogenic, mutagenic, sensitising		5.9.1.
	Substance, corrosive		5.9.1.
	Substance, explosive		
	Substance, harmful for environment		5.13.6.
	Substance, harmful, irritant		5.9.1.
	Substance, oxidising		5.9.1.

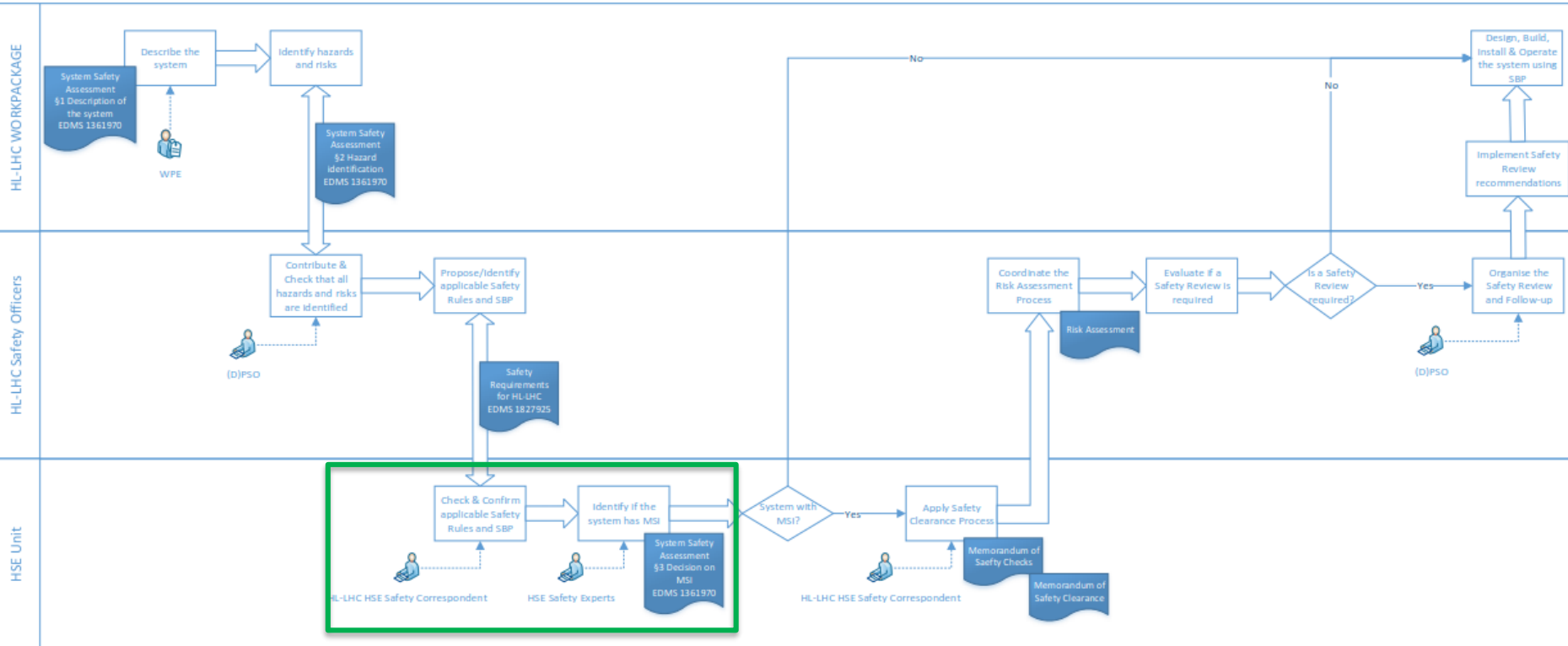
Systematic hazard list (100 entries)

References to Standard Best Practice



# HSE Review

## HAZARD IDENTIFICATION AND RISK ASSESSMENT PROCESS AT SYSTEM LEVEL (EDMS 1827925)

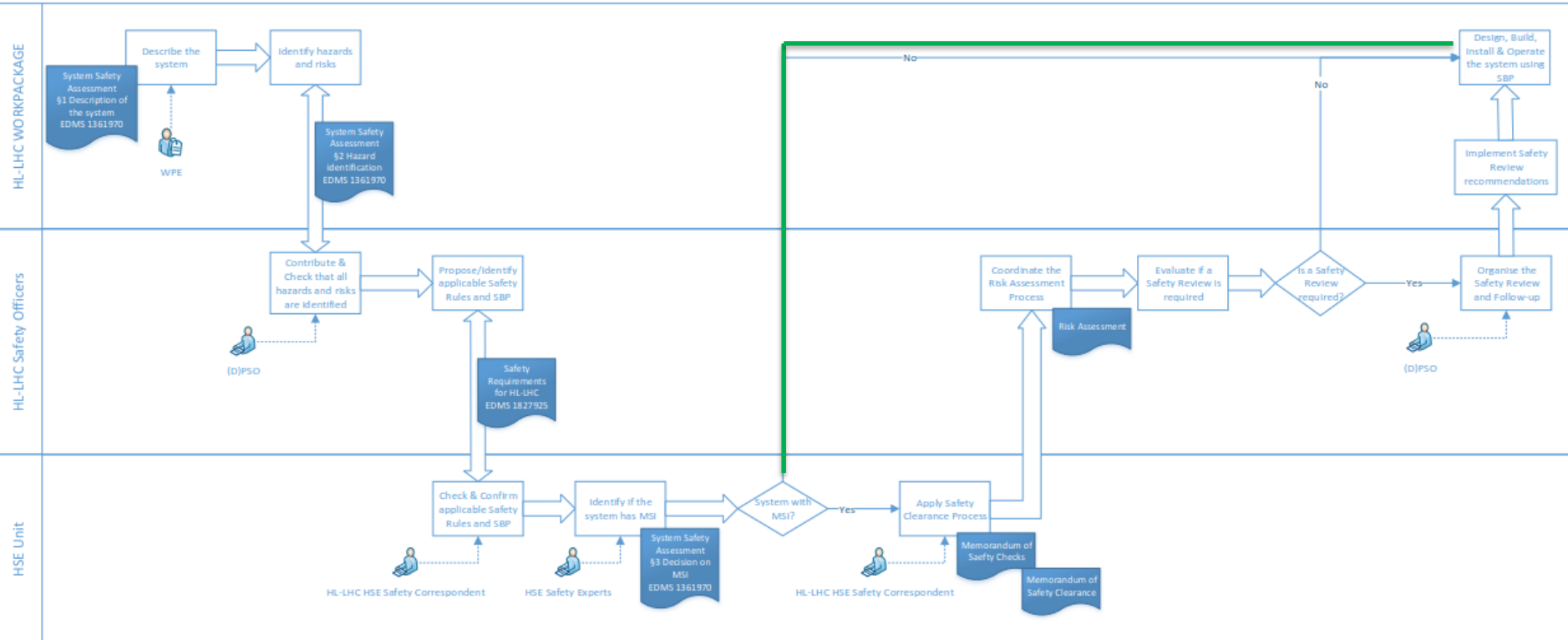


# HSE Review

- The System Safety Assessment form with
  - Identified hazards
  - Proposed standard best practice
- Is submitted to HSE for review
  
- HSE may judge, based on experience and other soft criteria, that the hazards of the subsystem are
  - Either fully covered
  - Or not entirely covered – **major Safety implication**

# Hazards fully covered

HAZARD IDENTIFICATION AND RISK ASSESSMENT PROCESS AT SYSTEM LEVEL (EDMS 1827925)

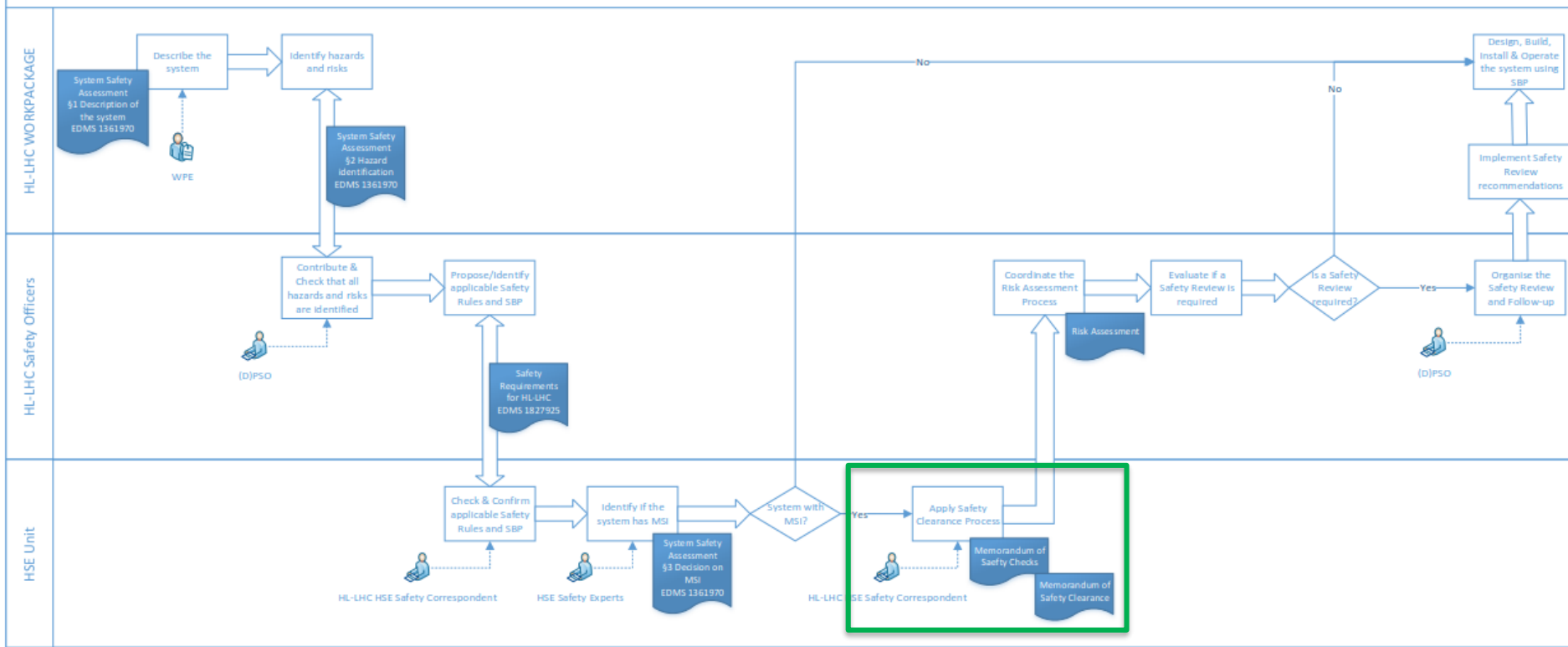


# Hazards fully covered

- The Workpackage proceeds with
  - Design (hazard identification at the design stage enables cost and time effective” safety by design” approach)
  - Construction
  - Installation
  - Commissioning
  - Operation
- documenting at every step the implementation of the Standard Best Practice measures.

# Subsystem has “major Safety implications”

HAZARD IDENTIFICATION AND RISK ASSESSMENT PROCESS AT SYSTEM LEVEL (EDMS 1827925)

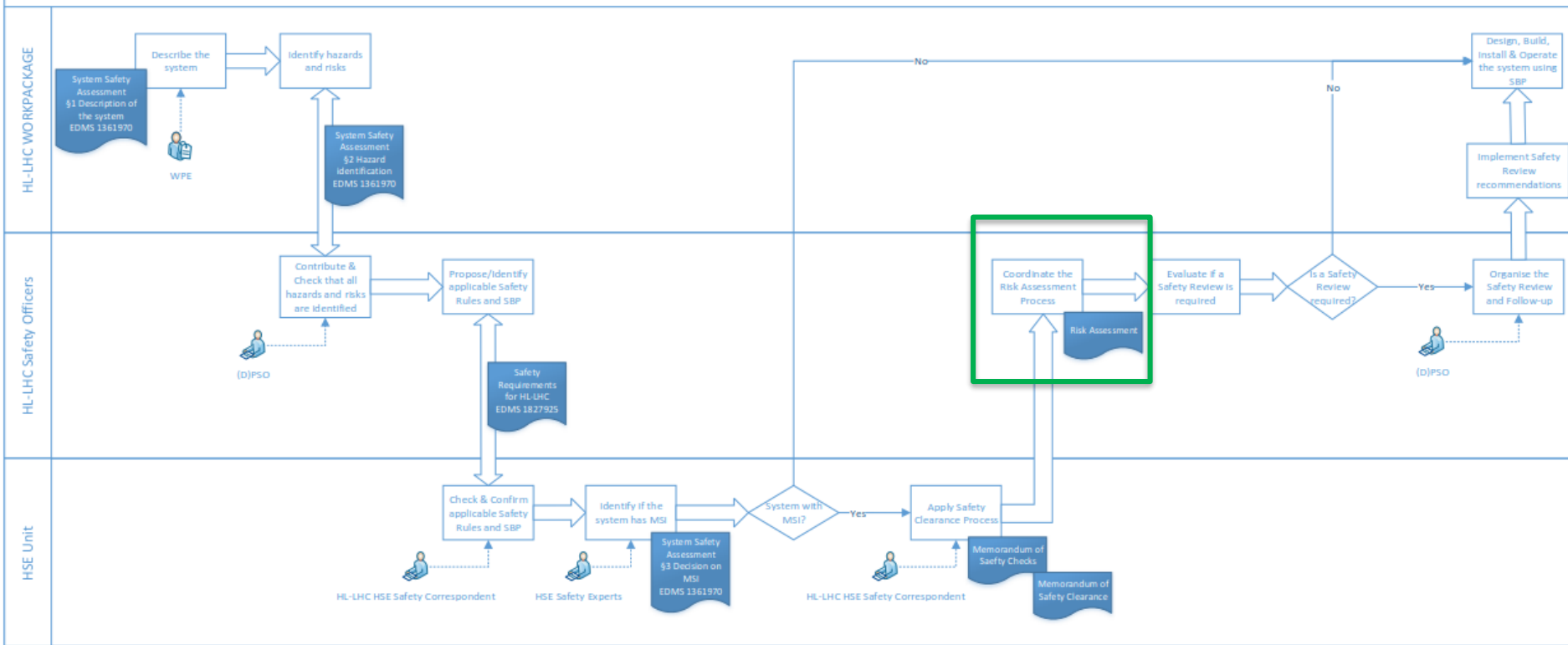


# Subsystem has “major Safety implications”

- HSE unit lists the “Safety Checks”:
- At defined moments in the production process, safety documents must be submitted to HSE
  - Calculation notes
  - Test certificates
- At major intermediate steps (e.g. pressure test, commissioning), HSE experts may be present
- Before operation, HSE unit gives “Safety Clearance” based on satisfying submitted documentation.

# Risk Assessments

HAZARD IDENTIFICATION AND RISK ASSESSMENT PROCESS AT SYSTEM LEVEL (EDMS 1827925)

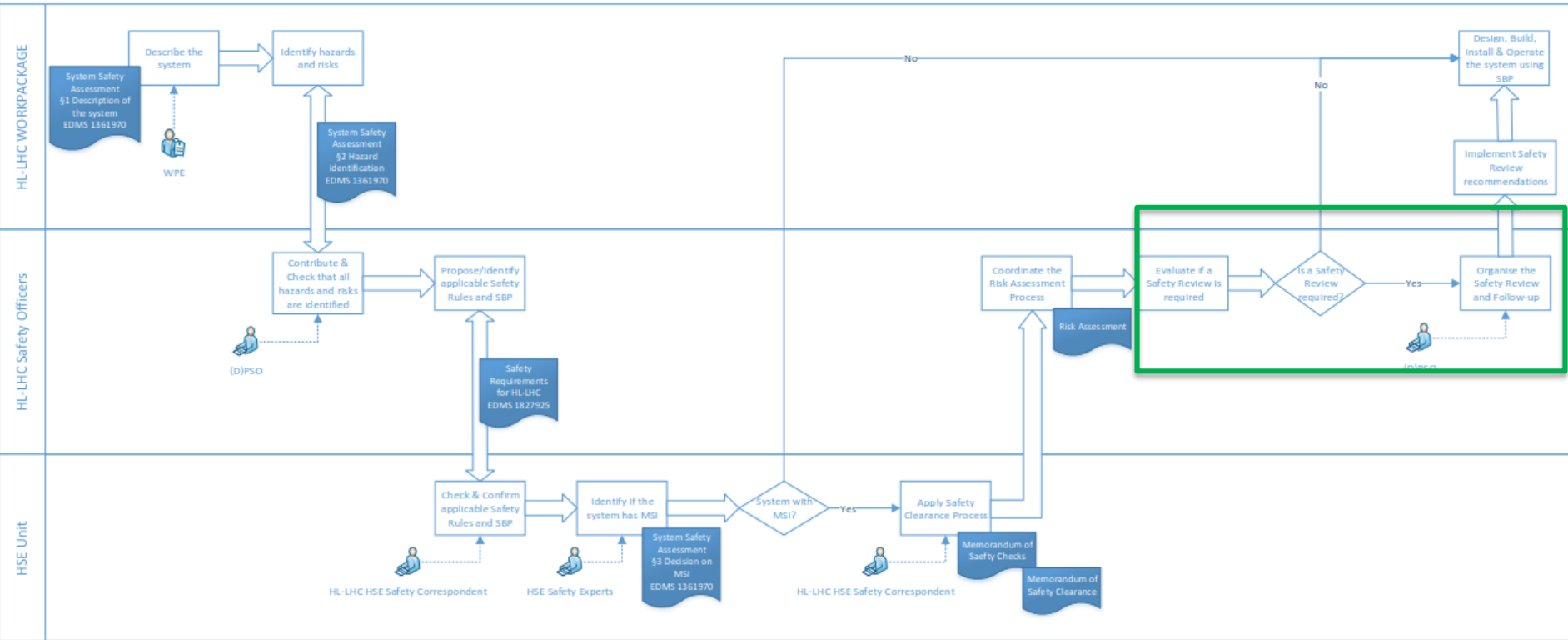


# Risk Assessments

- Risk assessments may be required to identify the optimal mitigation for hazards for which no SBP was identified
- Risk assessments are conducted by HL-LHC Safety Officers
- The implementation of the agreed mitigation measures are documented in the Safety documentation of the Subsystem

# Safety Review

## HAZARD IDENTIFICATION AND RISK ASSESSMENT PROCESS AT SYSTEM LEVEL (EDMS 1827925)

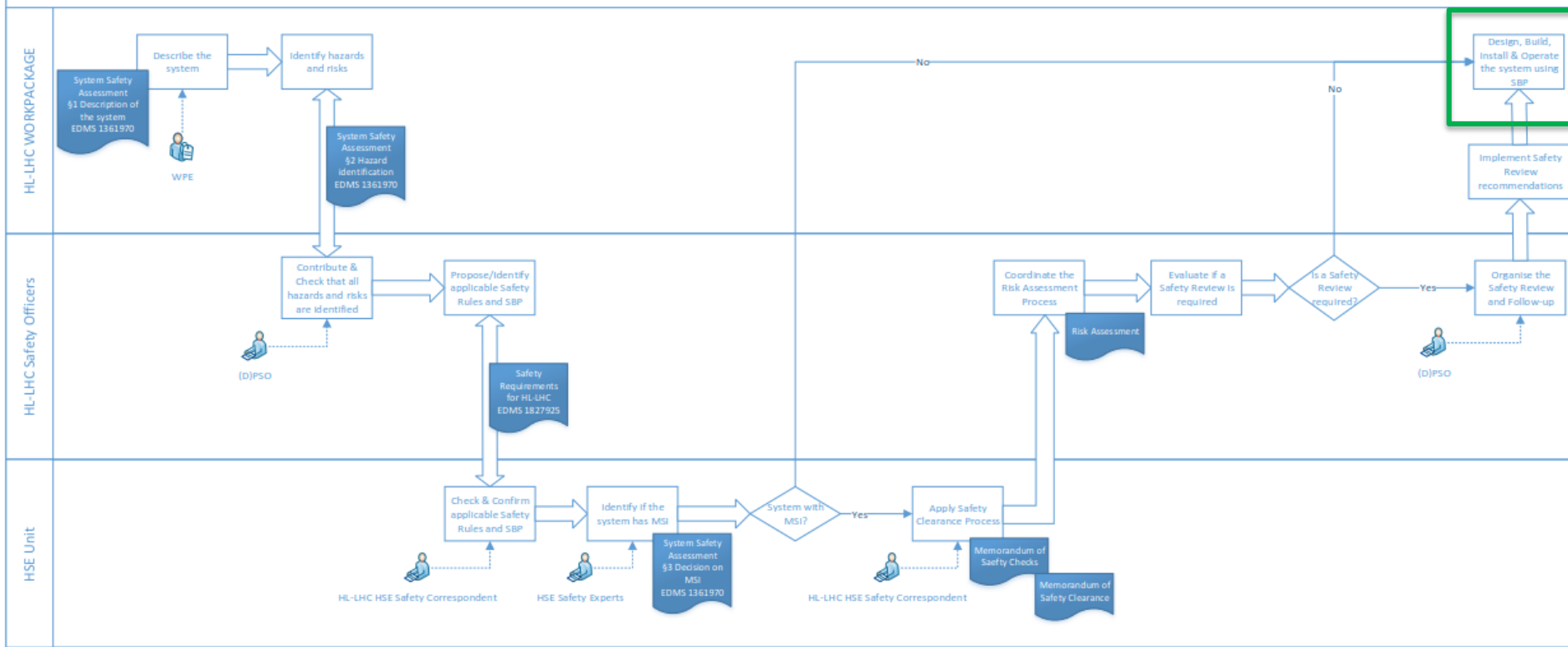


# Safety Review

- For certain Subsystems which may imply a high risk to personnel or the installation, HL-LHC Safety officers may propose a Safety Review (e.g SPS crab cavity Test Stand)
- This is generally a CERN internal review
- The implementation of the Safety Review's recommendations are documented in the Safety documentation of the Subsystem

# Final Steps

HAZARD IDENTIFICATION AND RISK ASSESSMENT PROCESS AT SYSTEM LEVEL (EDMS 1827925)



# Final Steps

- Safety documentation is compiled during construction, testing and commissioning
- Once the project is terminated and a subsystem starts regular operation, the Safety documentation is attached to the (HL-)LHC Baseline documentation and the Departments take over the safety documentation edition process.

# Process Description

## Safety Requirements for HL-LHC hardware systems (Conventional aspects)

### PURPOSE & SCOPE

This document, named **Safety Requirements for the HL-LHC hardware systems (Conventional aspects)** is adapted from the Launch Safety Agreement (LSA) procedure. Whereas the general LSA fits the needs of smaller scale projects and experiments, the procedure is modified to better address the challenges of HL-LHC.

This document, elaborated in close collaboration between HL-LHC Safety Officers and the HSE unit, is the reference for safety requirements applicable to all HL-LHC hardware systems.

HL-LHC hardware systems are designed, built and operated according to the regulations in force at the time they are designed, traceable by the version number of this document. Should the regulations evolve, this document will be updated accordingly and a new version issued.

### HISTORY OF CHANGES

REV. NO.	DATE	PAGES	DESCRIPTION OF THE CHANGES
1.0	13-11-2017	All	Safety requirements Released

The process is described in

“Safety Requirements for HL-LHC Hardware Systems”,

EDMS 1827925

Contains also pointers to  
“Standard Best Practice”

# System Safety Assessment Form

EDMS NO. REV. VALIDITY  
0.1 DRAFT  
REFERENCE: HL-LHC SAFETY

**LAUNCH SAFETY AGREEMENT**  
**SYSTEM SAFETY ASSESSMENT**  
**WP XX: SYSTEM YY**

**Abstract**  
Short overview of the system  
- Its purpose  
- Location  
- Origin (make or buy)

**Identification of the System**  
WP  
Equipment Code:  
Location:  
Start date:  
Completion date:

**Organization of the WP**  
WP Leader:  
WP Engineer:  
PSO: Thomas Otto – Christelle Gaignant

Prepared by:	Checked by:	Approved by:
WP Engineer PSO	Stake Holders	Stage 1: WPL and HSE Corr.  Stage 2: Project Leader

EDMS reference of this form: 1361970  
This document is uncontrolled when printed. Check the EDMS to verify that this is the correct version before use

Unique document to follow the Safety Assessment process from Hazard Identification until Safety clearance for operation

New version at every step in the equipment history

Collects all relevant information in short form

Technical details in referenced documents

EDMS 1361970

# Summary

- The proven LSA process for small projects has been suitably adapted to
  - A large project like HL-LHC
  - With professional Safety officers
- The adopted Safety Assessment process will be lighter and more rapid, as the Project Safety Officers take over a number of steps usually performed by the HSE correspondent.
- Resources can be optimised and targeted to the Subsystems with safety relevant impact.
- Use of this process as of October 2017
- Progress determined by delivery deadlines of subsystems



**Thank you for your attention**

