A photograph of two large, white, cylindrical cooling towers of a nuclear power plant. They are situated on a grassy bank next to a body of water. The towers are emitting thick plumes of white steam that rise into a clear blue sky. The towers and the steam are reflected in the calm water in the foreground. In the bottom left corner, there is a white silhouette of four people (two men and two women) holding hands.

Development of a new IEC standard for HDL-programmed integrated circuits performing category B or C functions

EDF Nuclear Engineering Division, Basic Design (SEPTEN)

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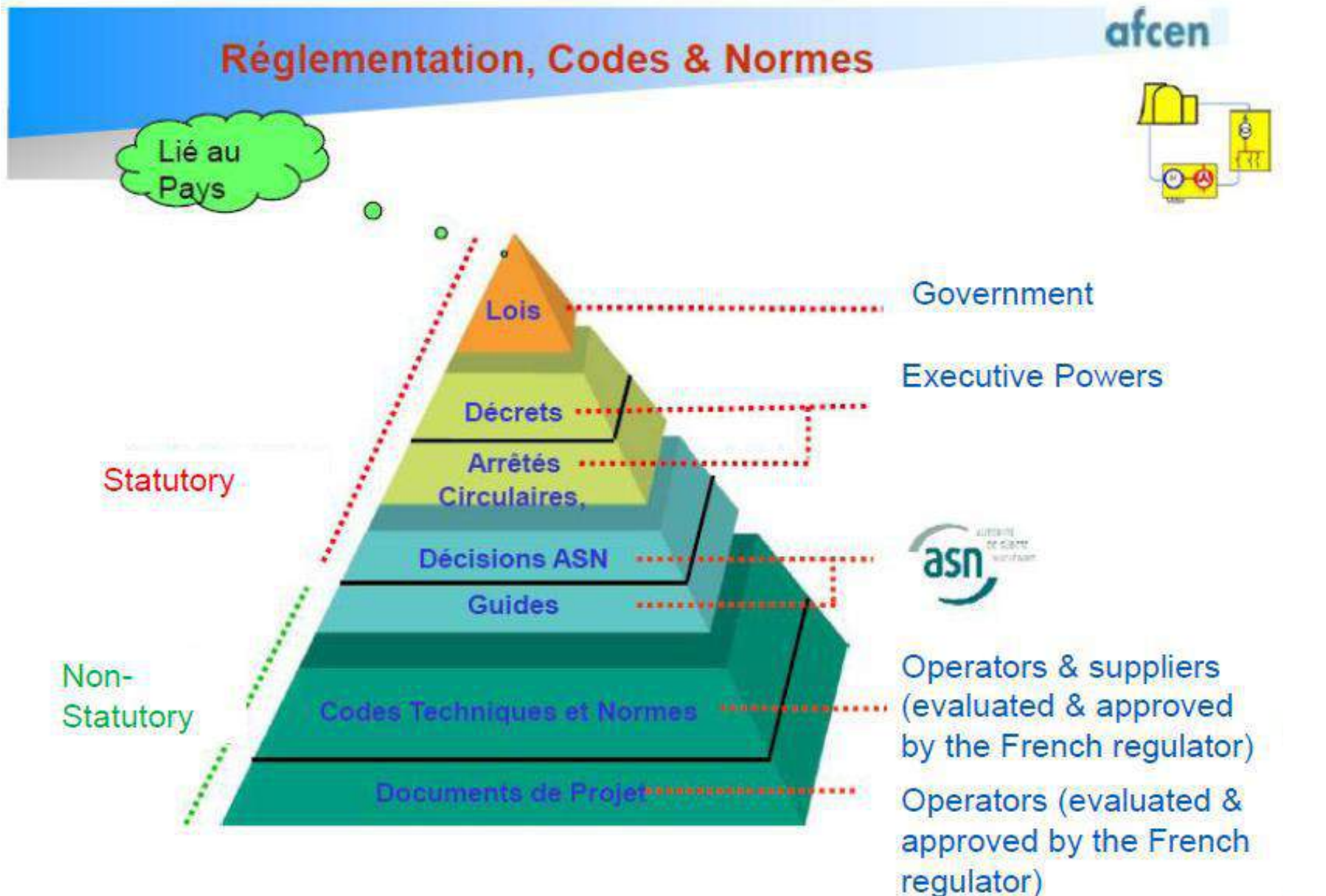


- Regulatory context for FPGA use
 - RCC-E and Standards
 - New standard development



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Regulatory context for HPD use



AFCEN : French Association for Design, Construction and Operational Rules for Nuclear Power Plants

Rapport de Sûreté et Codes de conceptions

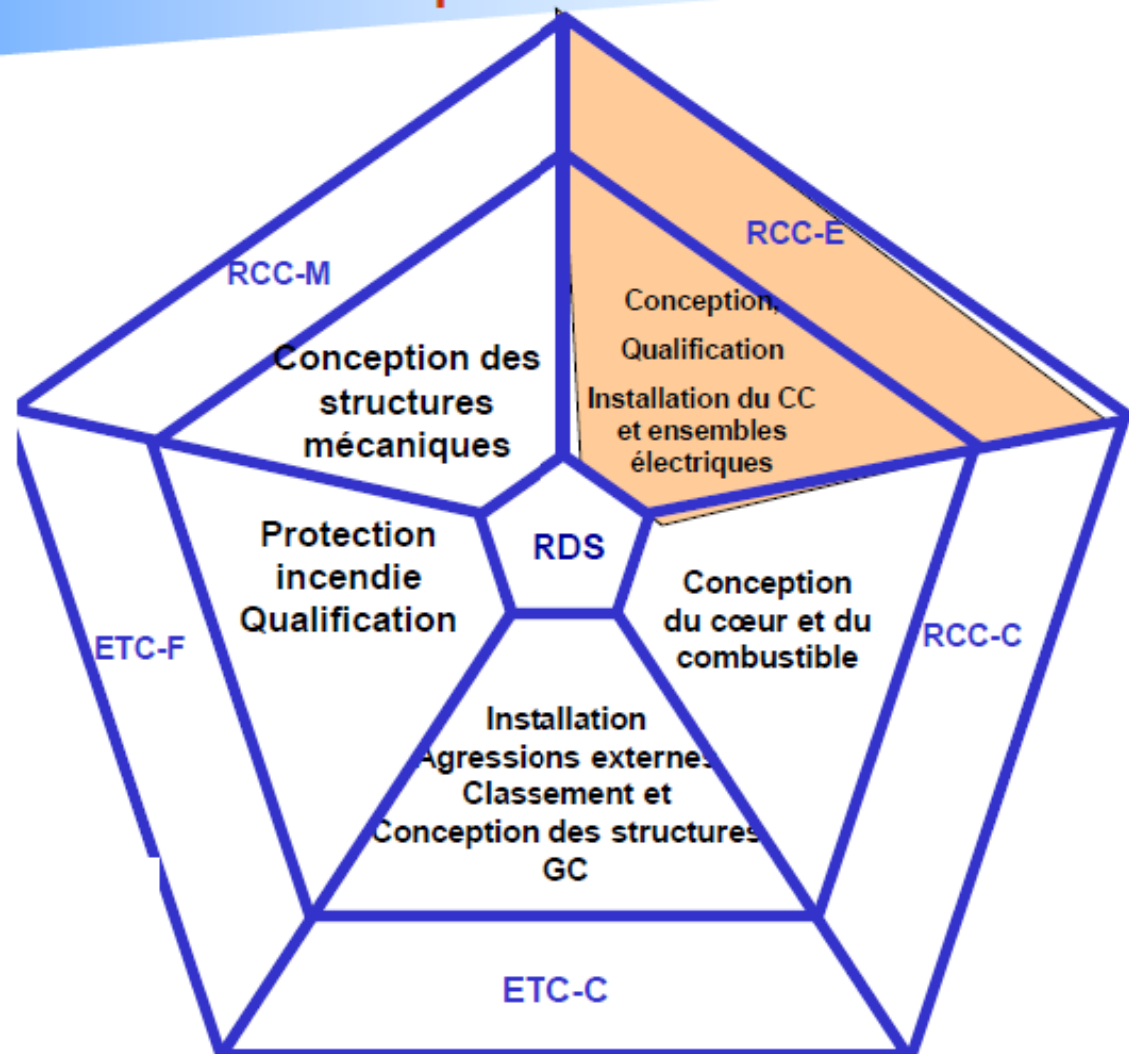
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RCC-E: Design and Construction Rules for Electrical Equipment of Nuclear Islands

Evaluated and approved by the French Regulator

Concerns the design, qualification and installation of electrical equipment.

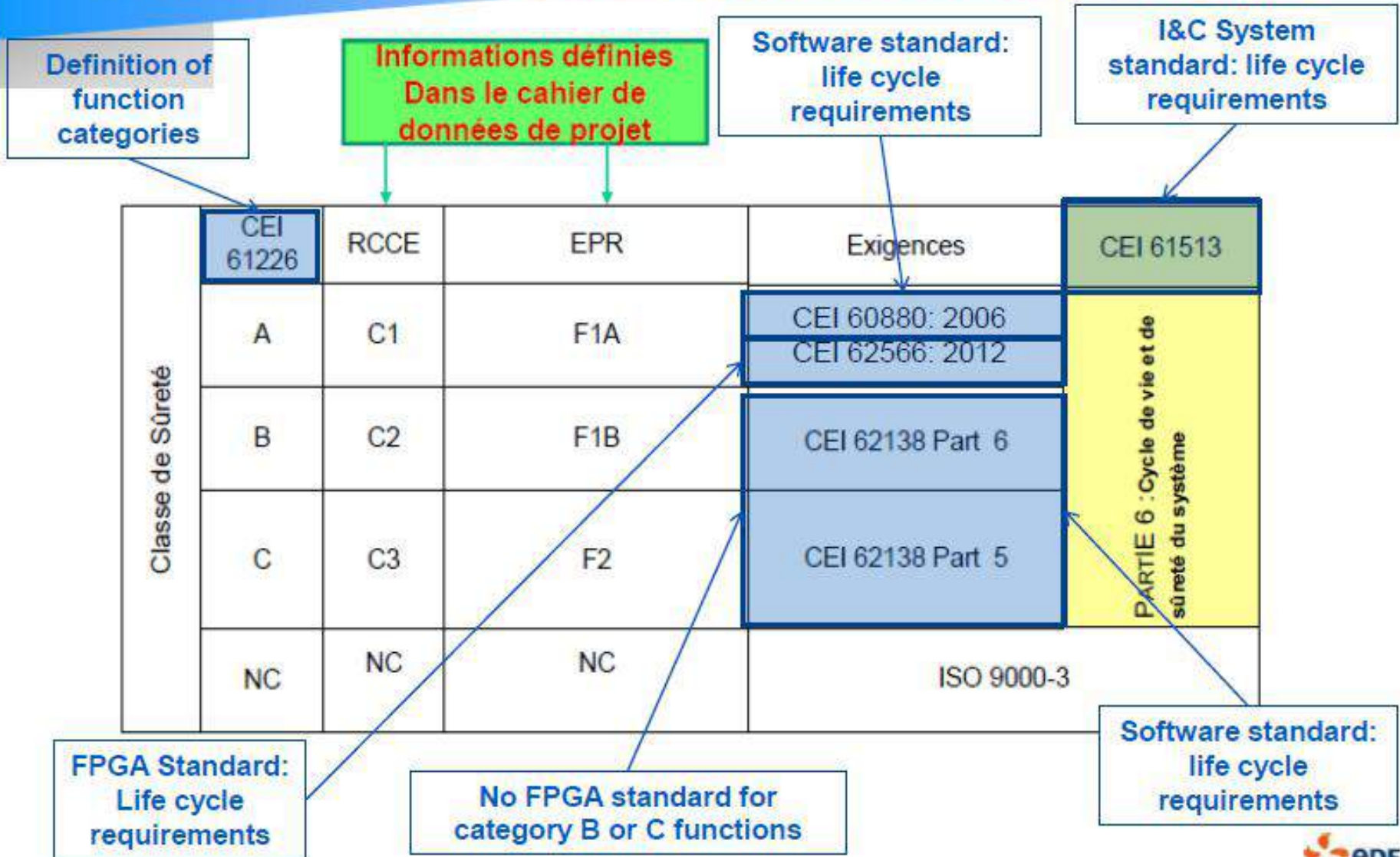
Chapter C5000 concerns the development of *software* based I&C systems. FPGAs are not addressed in the current version (2012)



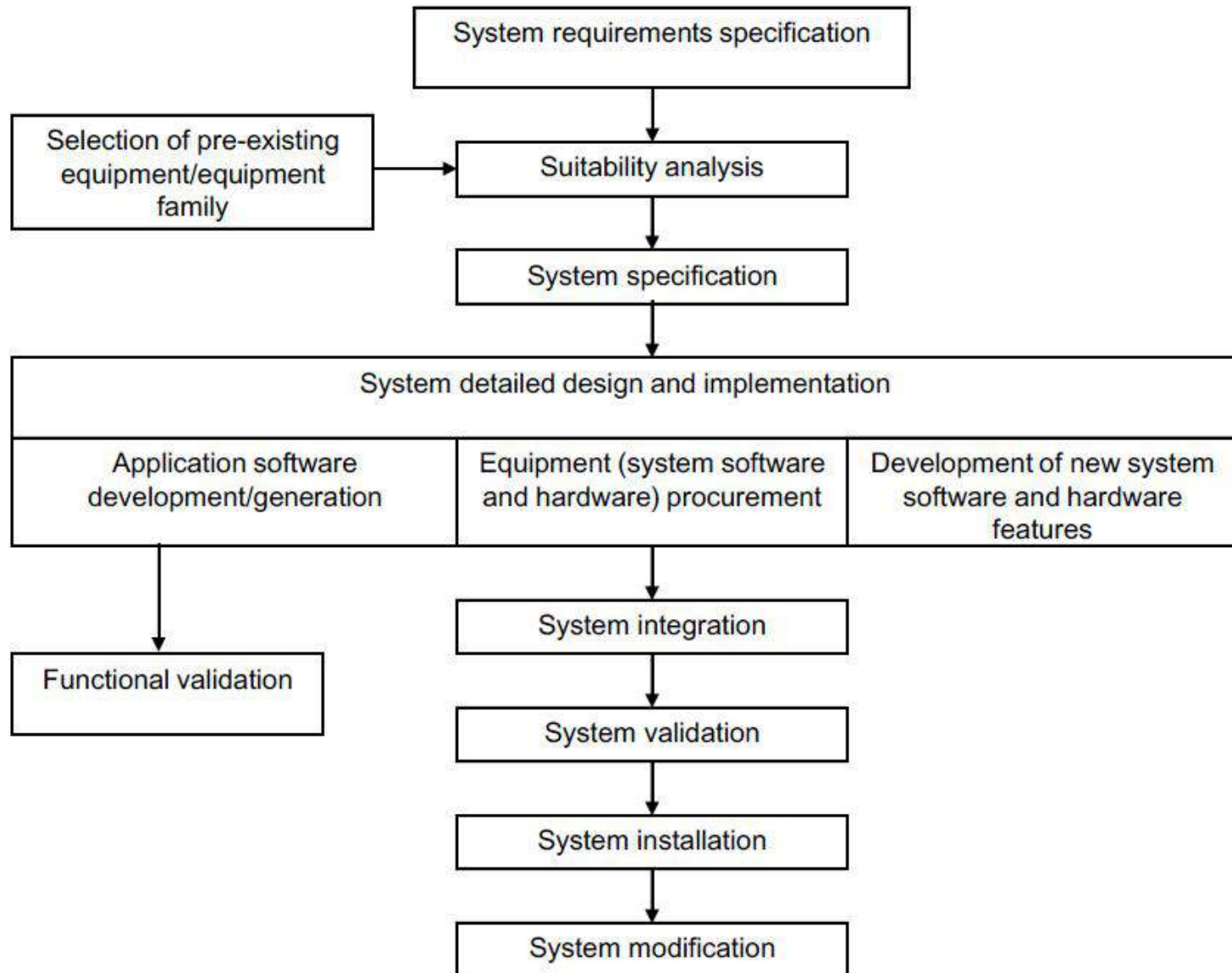
RCC-E : Defining design requirements for I&C systems

atcen

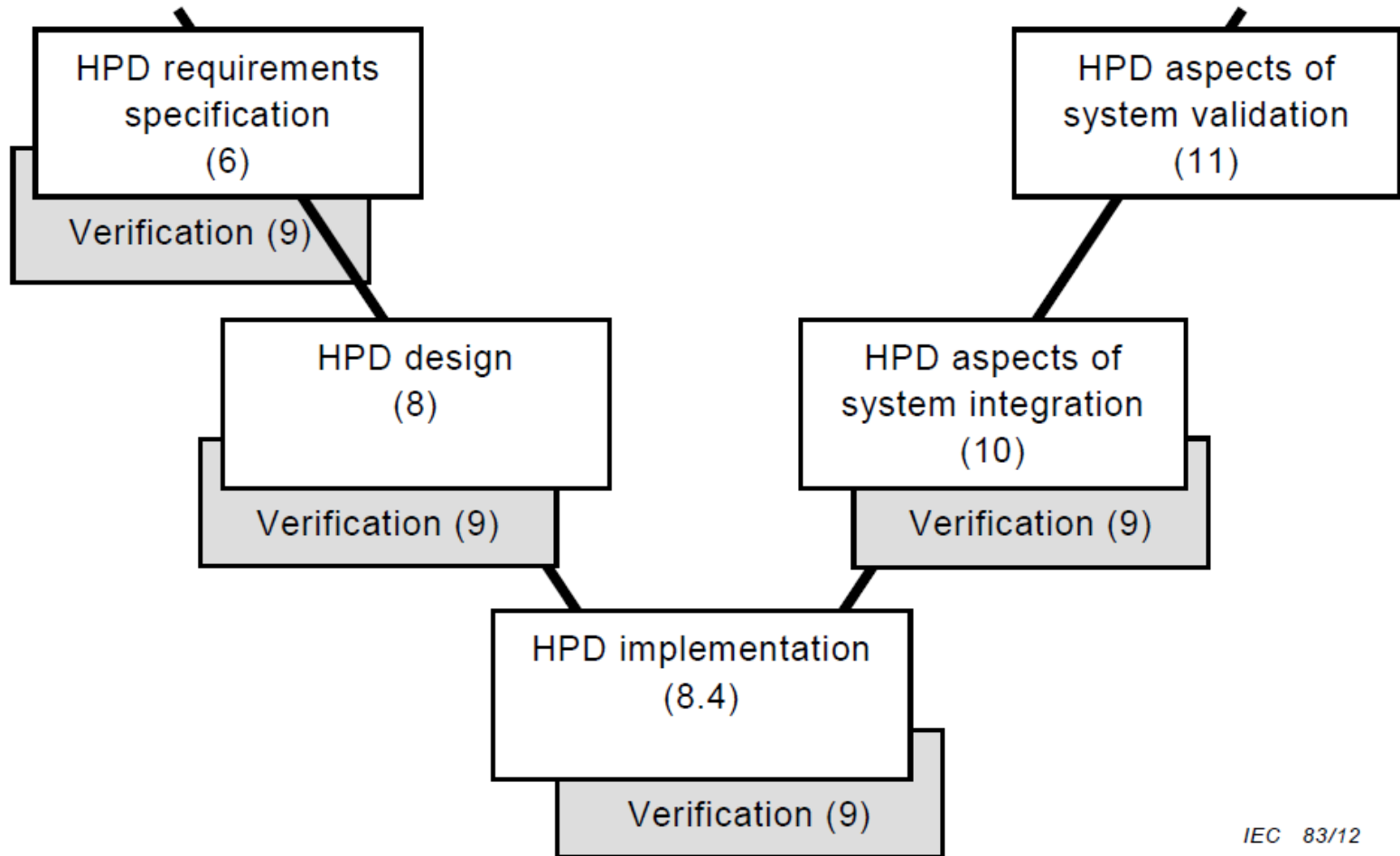
Exigences de conception du contrôle commande



IEC 61513 : System-level requirements



IEC 62566 : Class 1 HPD requirements



IEC 83/12

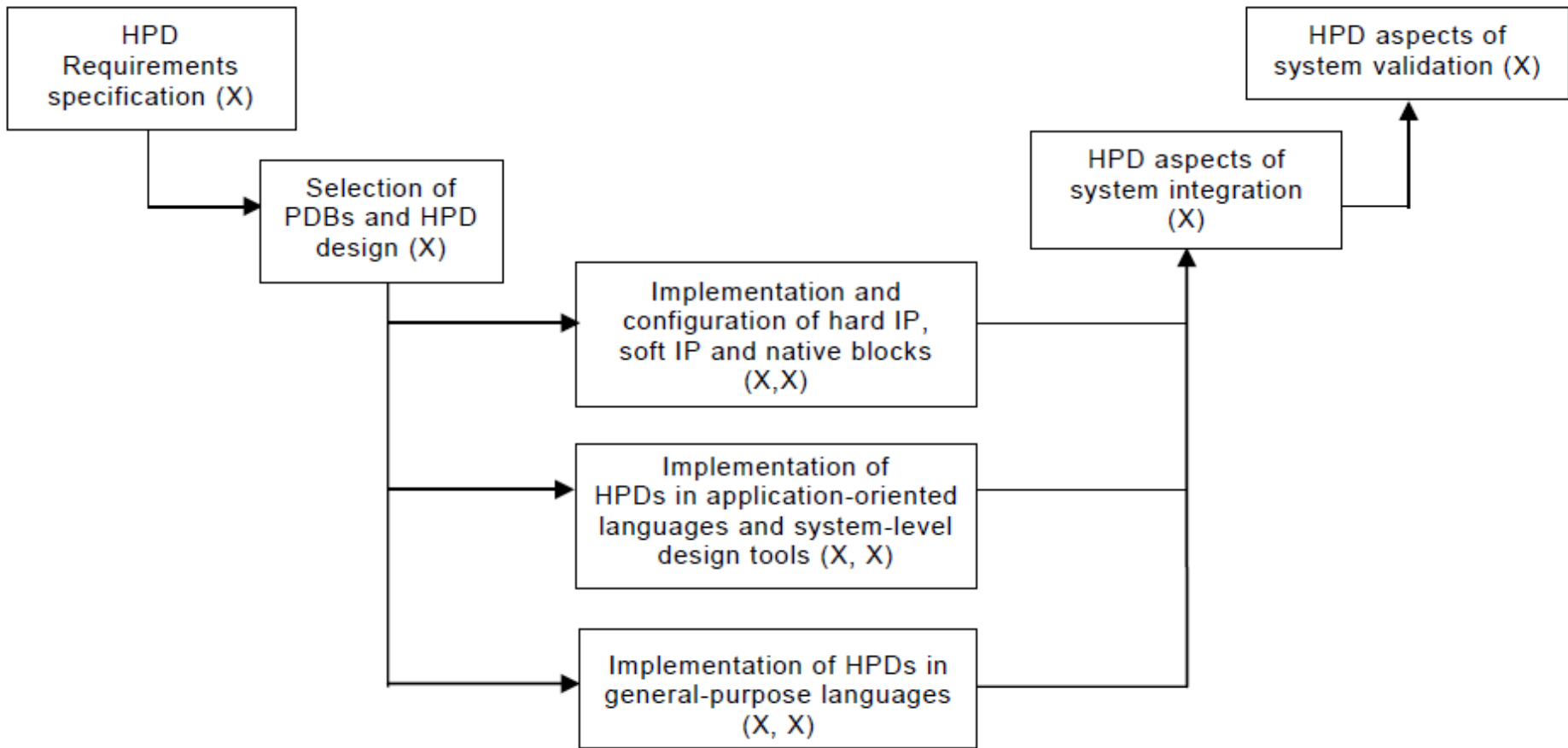
IEC 62566-2 : Class 2 and 3 HPD requirements – some fundamental decisions

- Conservation of the structure of IEC 62566
 - This ensures that the difference in severity of requirements is clear and also that a structure oriented around the specificities of the HPD development process are maintained.
- Coherence with IEC 62138 in terms of requirement severity
 - This ensures that the severity of requirements does not impact the technological choices made by the developer.
- Introduction of graduation principles as per IEC 62138
 - To provide coherent and appropriate differentiation between class 2 and 3 compared to software standards.
- Reference to IEC 62138 for general requirements which are independent of the technological specificities of HPD developments (quality assurance, project management etc.)
 - IEC rules dictate that when requirements are taken from other standards, they should be referenced instead of copied.

IEC 62566-2 : Class 2 and 3 HPD requirements – further developments

- Removal of requirements concerning deterministic design
 - Such requirements would need to be taken into account from the initial design stages, or for predeveloped items would result in the need for very detailed information about the internal operation of the component. In France, deterministic behavior is a requirement for class 1 systems only.
- Maintaining requirements concerning predictable design for class 2, removal of such requirements for class 3
 - Such clauses require detailed design information and cannot reasonably be expected for class 3. In certain cases, requirements might be downgraded to recommendations for class 3.
- Conservation of requirements which simply reflect good industrial practice
 - Even if there is no equivalent in IEC 62138 and as long as they are not too penalising in terms of cost or implementation time.

IEC 62566-2 : Class 2 and 3 HPD requirements – different types of implementation



IEC 62566-2 : Class 2 and 3 HPD requirements – specific developments and need for discussion

▶ §7: Acceptance process for programmable integrated circuits, native blocks and pre-developed blocks.

- This section will require significant development compared to IEC 62566, which is oriented toward the development of HPDs, rather than the acceptance process for pre-developed items.
- The need for pre-developed items will increase significantly due to the nature of the functions that are likely to be implemented in class 2 systems.
- Possibility of introducing a flow chart describing the acceptance process for pre-developed items as per IEC 62138 edition 2.

▶ §8.3: HPD Design

- The following specific design requirements are too severe for class 2 and 3 and need to be removed : Power management, initialisation, non-functional configurations, testability.

▶ §8.4 : Implementation

- Need to adapt implementation requirements to allow for increased use of pre-developed blocs, native blocs, integrated microprocessor cores.

IEC 62566-2 : Class 2 and 3 HPD requirements – specific developments and need for discussion

▶ §8.5 : System level tools and automated code generation :

- Possible displacement of these requirements into chapter 15 : Software tools for the development of HPDs.

▶ §9 : HPD verification and validation

- Possible need to separate verification and validation requirements.
- Verification requirements are taken from IEC 62138. Requirements from IEC 62566 are too severe, in particular the level of independence between design and verification teams.
- It might be possible to move verification requirements to the beginning of the standard, but structural coherence with IEC 62138 will be lost.
- Validation requirements for test benches, test coverage, test execution and static verification are too severe for class 2.

▶ §10 : HPD aspects of system integration and §11 : HPD aspects of system validation :

- Need for reduced emphasis on unit testing and integration testing as per IEC 62138.

IEC 62566-2 : Class 2 and 3 HPD requirements – project planning

- ▶ New Work Item Proposal presented at the IEC SC45A meeting in Gyeongju in the Republic of Korea in March 2016.
- ▶ A second version will be distributed within the WGA3 group in January 2017.
- ▶ Following comments received, the first CD will be sent to the National Committees in April 2017.
- ▶ Following comments, the first CDV will be written and sent to the National Committees in preparation for the next IEC SC45A meeting in Shanghai in October 2017.
- ▶ Finalisation of the CDV following the meeting in Shanghai, followed by a 5 month review period beginning January 2018.
- ▶ Preparation of the final draft for SC45A meeting in March 2019 in Paris, with the objective of publishing the standard mid-2019.



Thank you for your
attention



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