

Addressing I&C Post-Fukushima requirements:

From regulatory requirements analysis
to systems design
and hardened instrumentation

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VVER 2013 – November 12th, 2013

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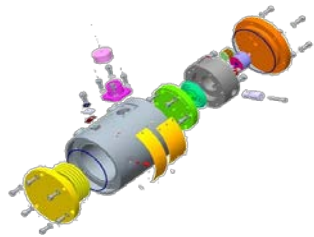
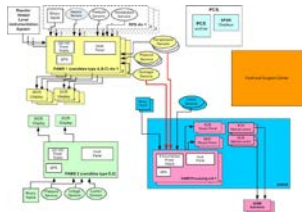
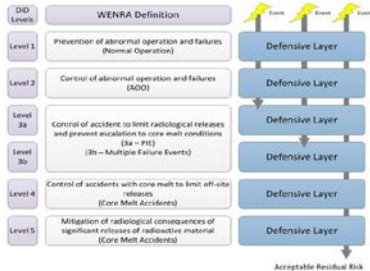
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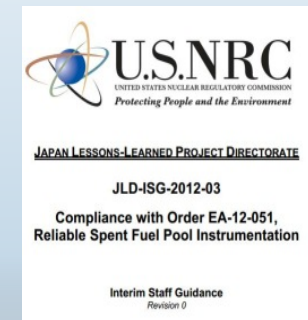
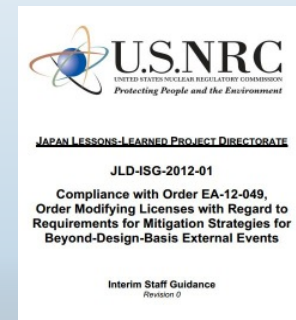
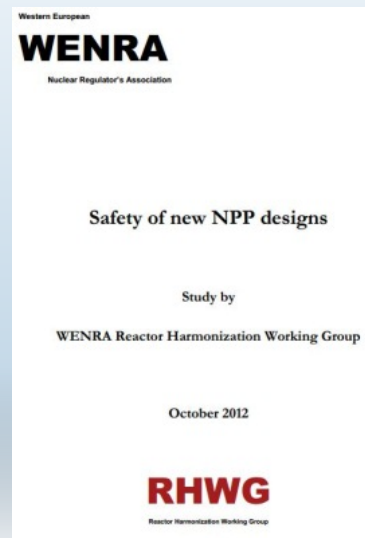
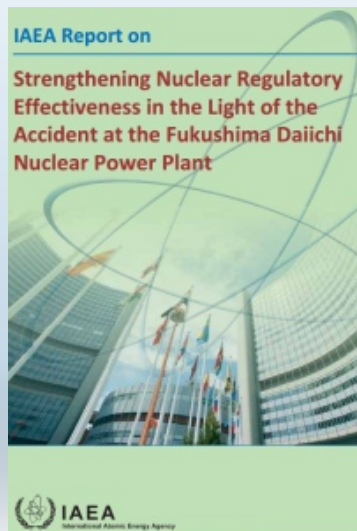
INTRODUCTION

New Regulations

Upgrades / New systems requirements

How to ensure compatibility with existing systems

Need for Hardened equipment



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REQUIREMENTS ANALYSIS: REQUIREMENTS TO COMBINE

New Post-Accident requirements:

- Stricter application of Defense-in-Depth
- Hardened equipment

Existing Requirements:

- Regulations
- VVER plant Design
- Site Specificities

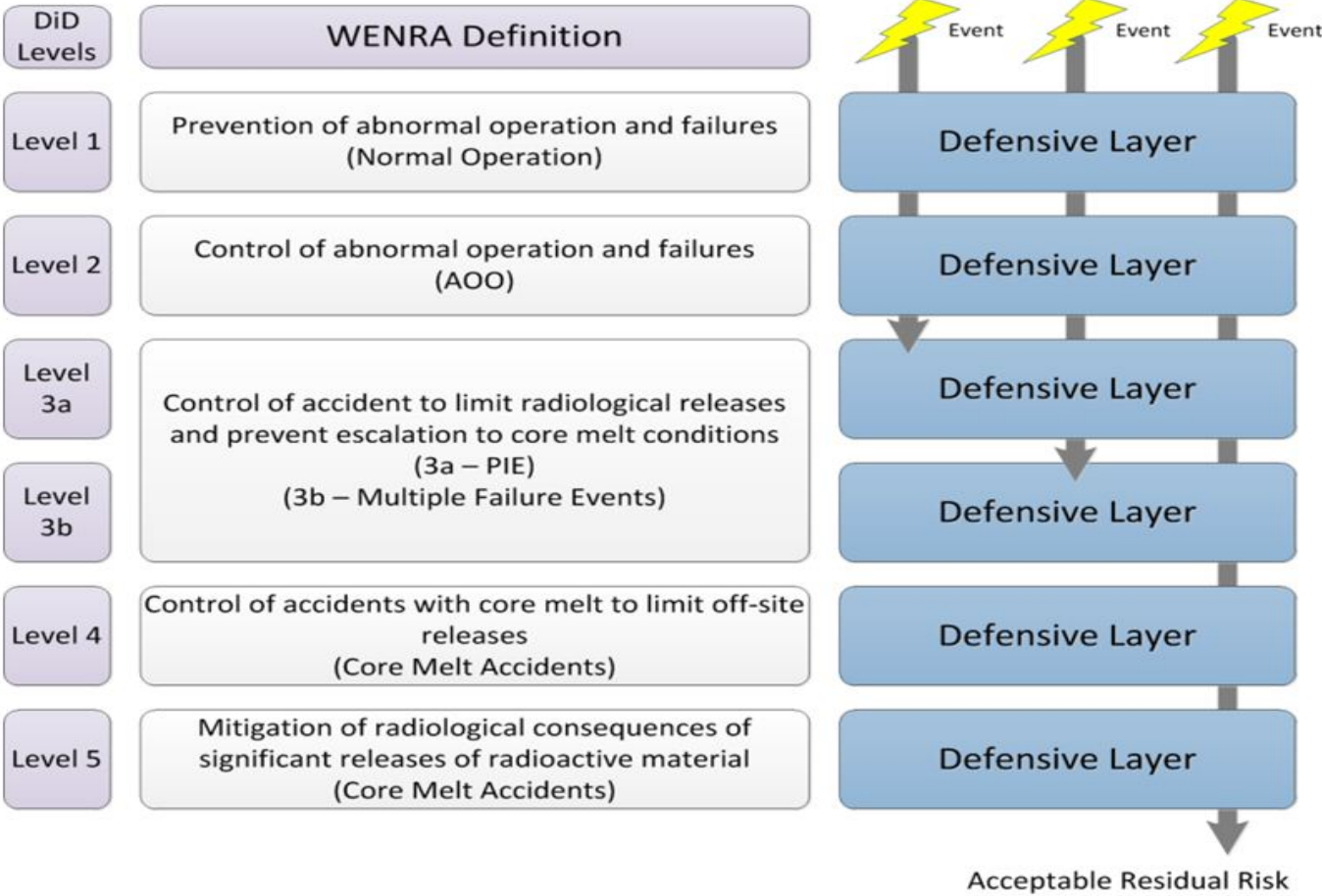


Compatibility with existing systems, Diversity

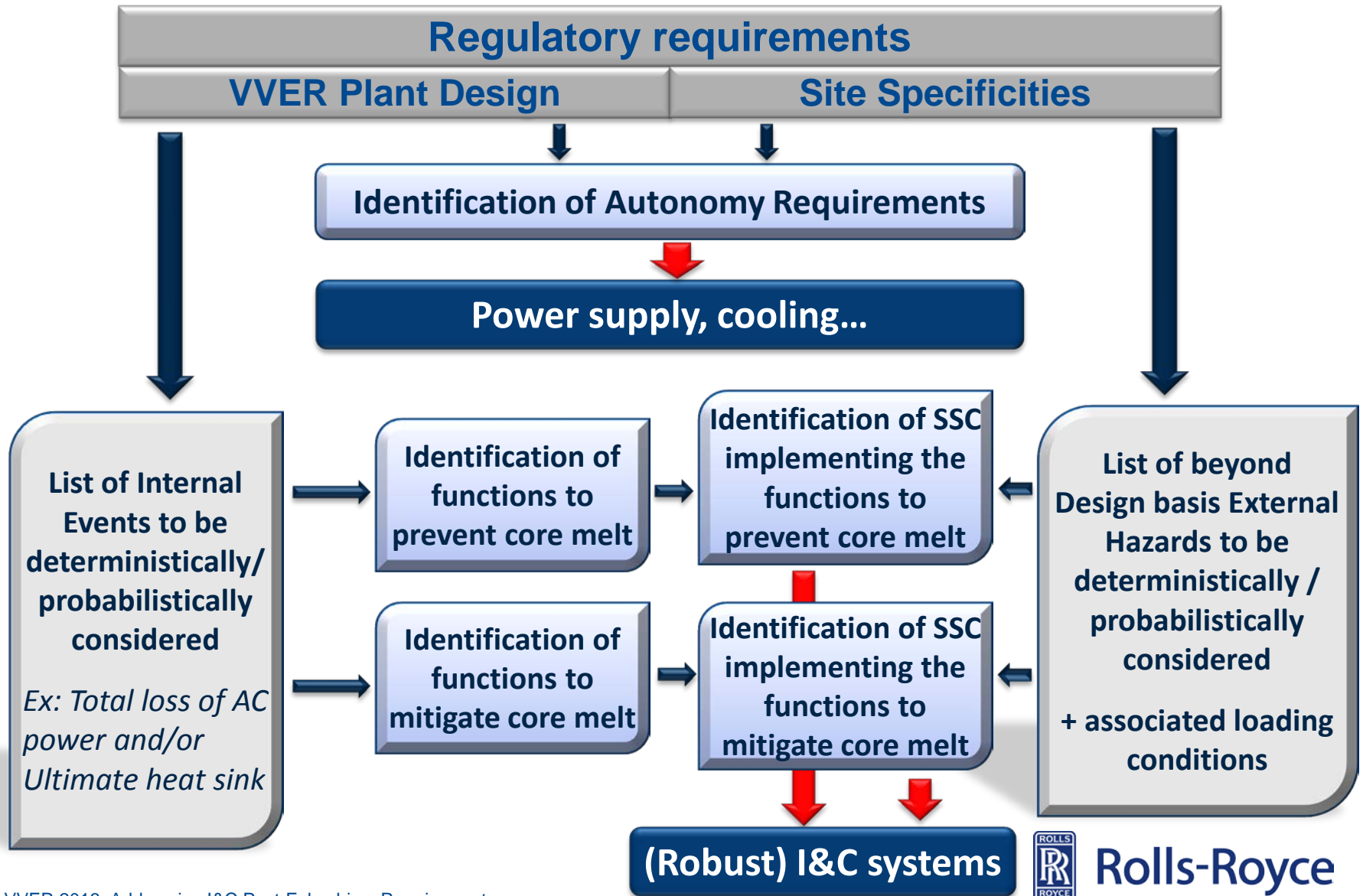


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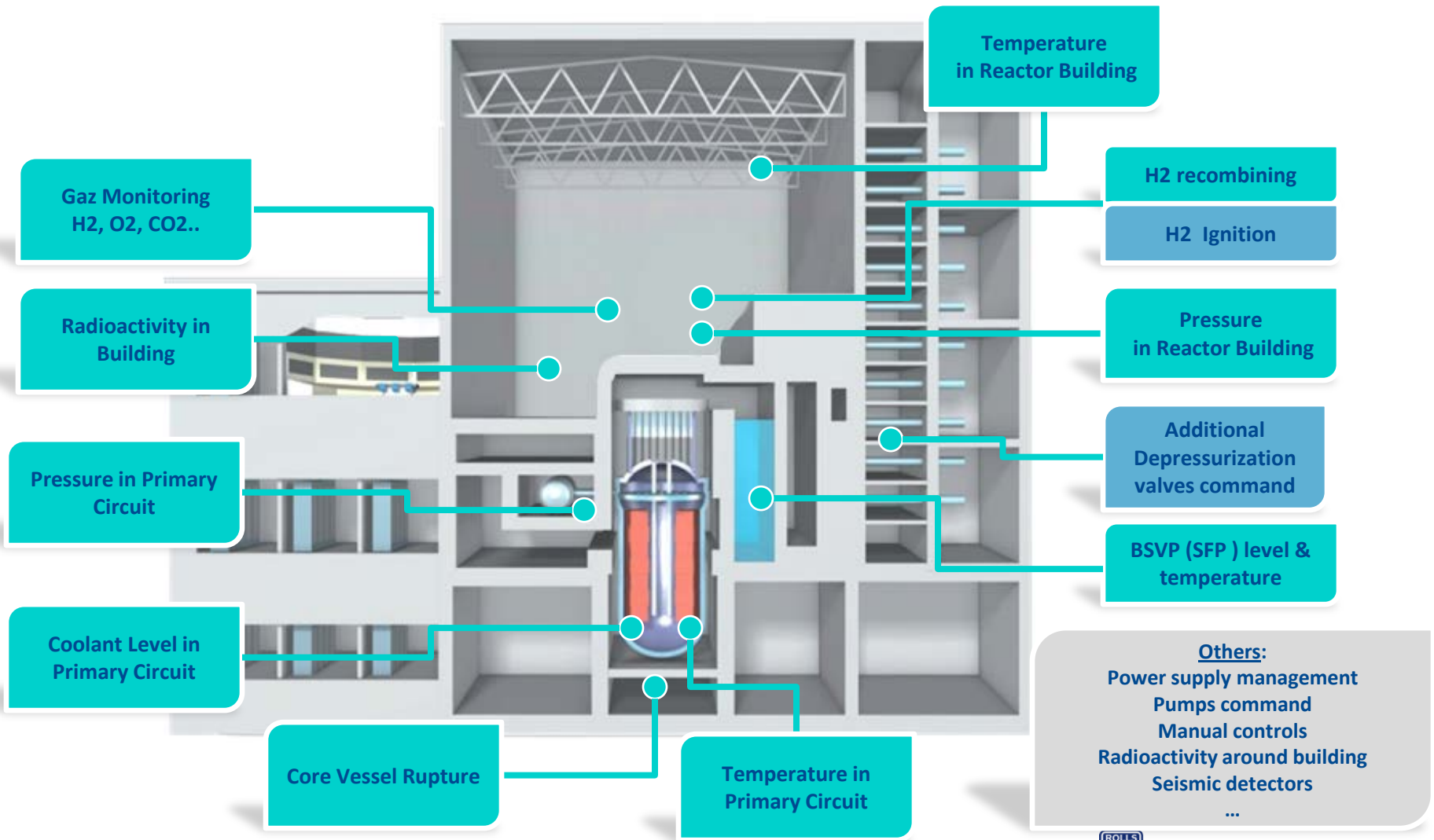
REQUIREMENTS ANALYSIS: PRINCIPLE OF DEFENSE IN DEPTH



FROM REQUIREMENTS TO SYSTEMS DEFINITION



ACCIDENT SYSTEMS: BASE I&C FUNCTIONS



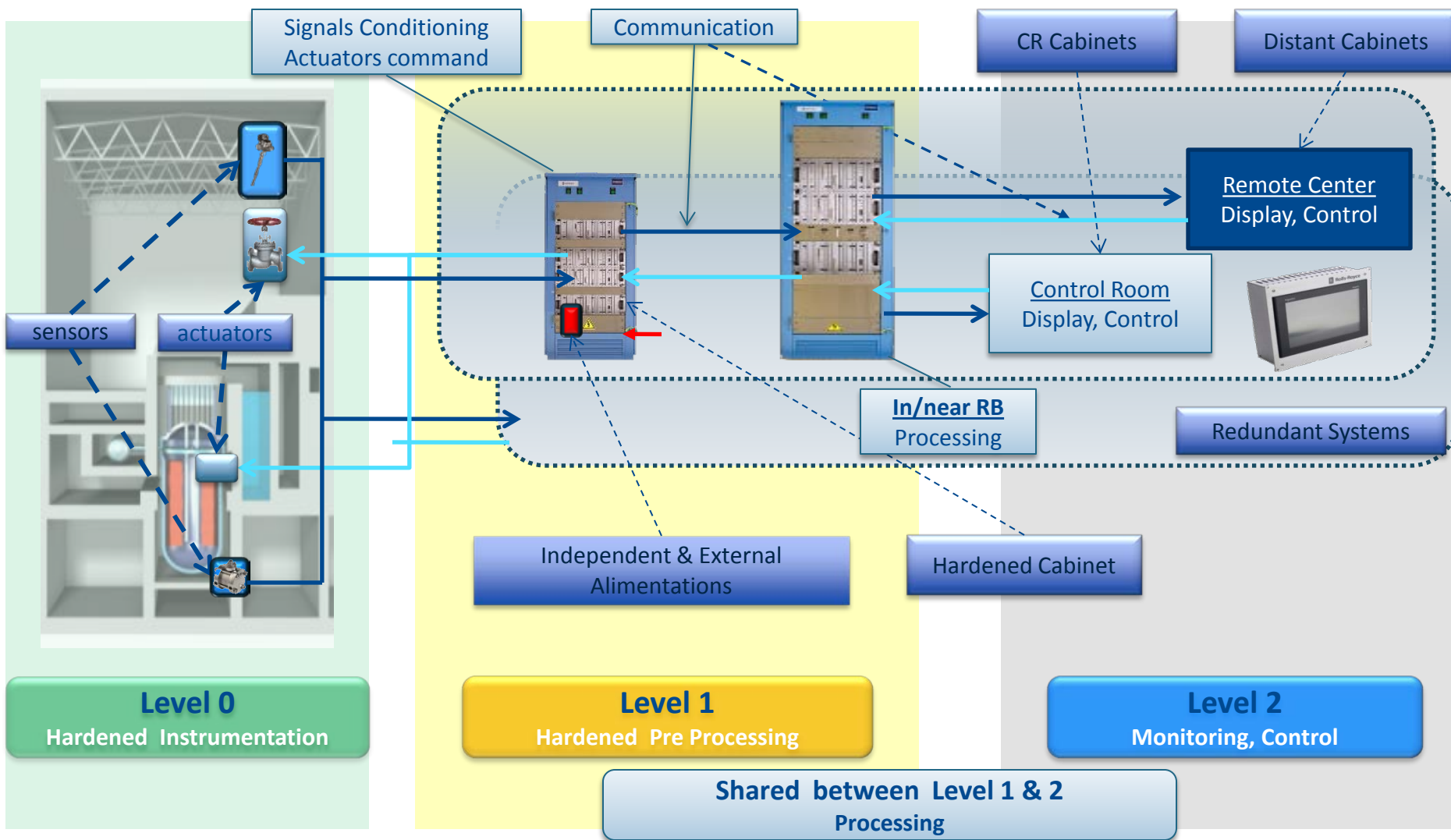
SYSTEM DESIGN: FLEXIBLE AND MODULAR

I&C Technology choice guided by: Regulations, Site specificities, VVER plant design, Experience

- **Compatibility with existing systems/sensors**
- **Technology platform: ex. Spinline™**
- **Variety of functions to implement**
- **D3: Defense-in-Depth & Diversity**

→ Need of flexible and modular technologies

Modularity: Complete I&C Architecture



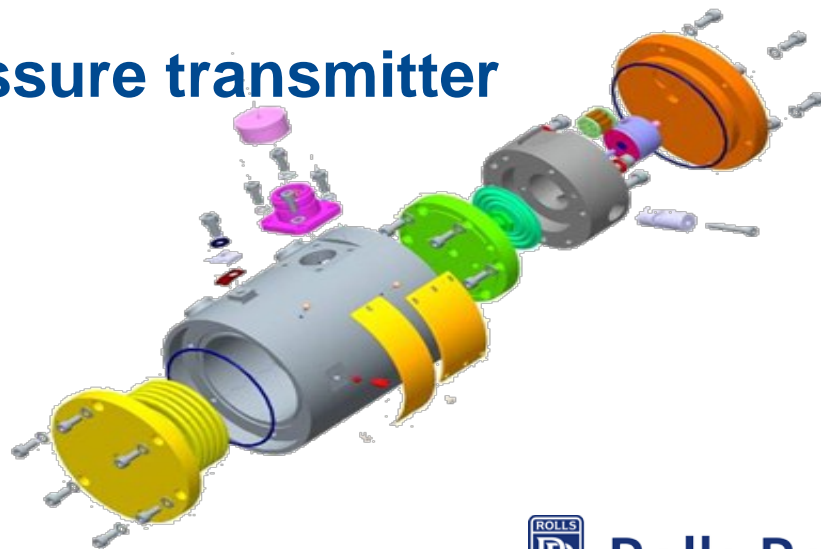
NEED FOR HARDENED EQUIPMENT

Equipment must withstand harsh environmental conditions

Stringent Seismic requirements

Instrumentation:

Example: Bibloc pressure transmitter

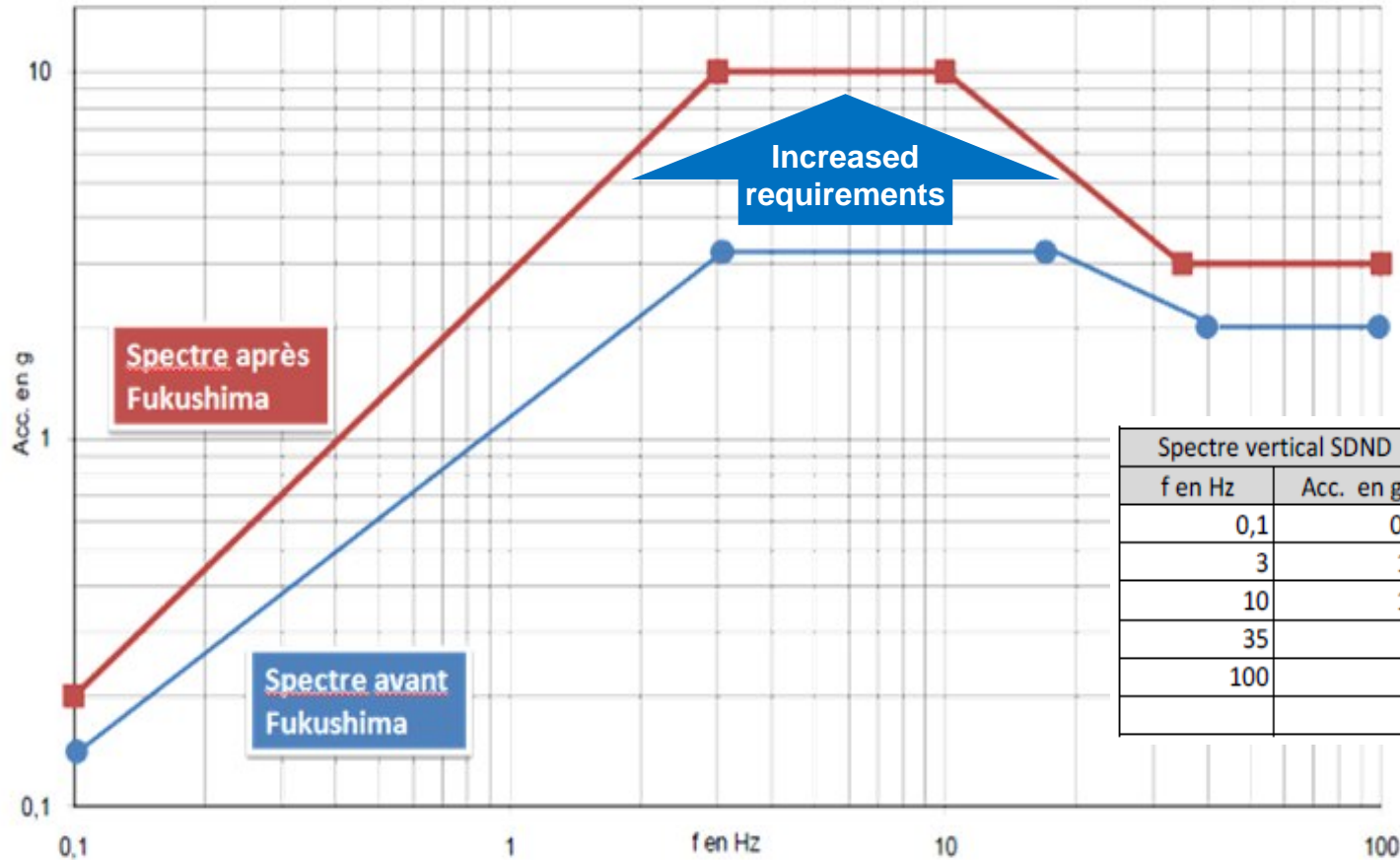


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Hardened cabinets & racks



Spectre horizontal



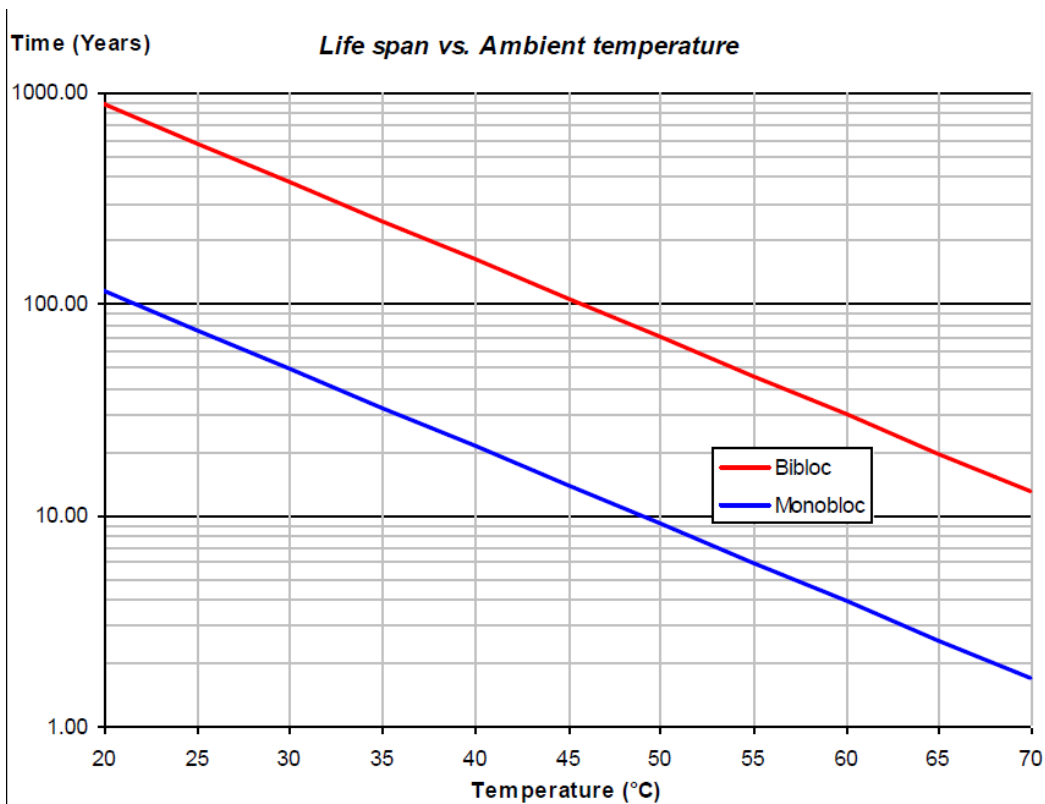
Spectre vertical SDND		Spectre horizontal SDND	
f en Hz	Acc. en g	f en Hz	Acc. en g
0,1	0,2	0,1	0,2
3	10	3	10
10	10	10	10
35	2	35	3
100	2	100	3



Bibloc pressure transmitters

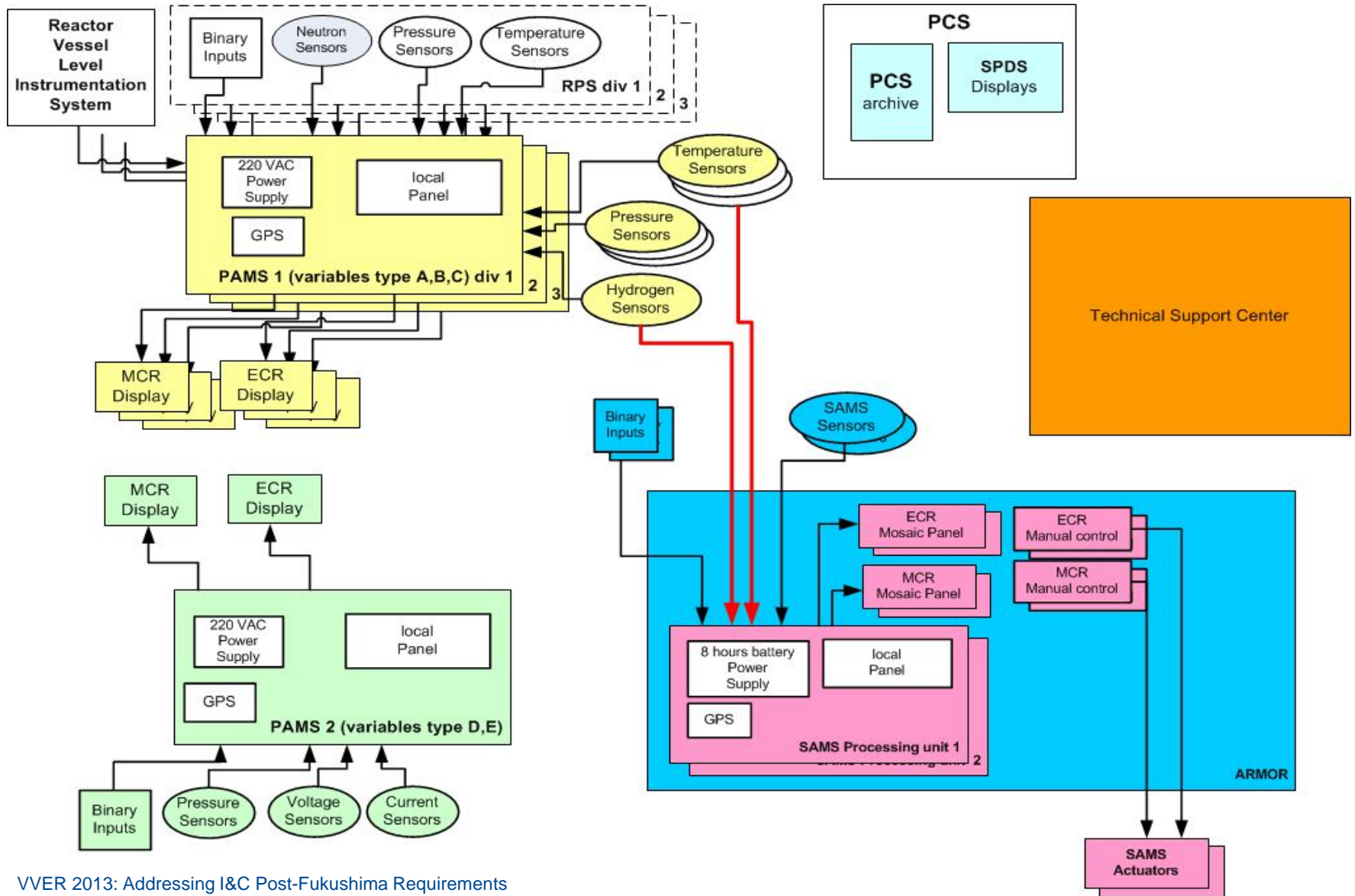
Two types of pressure transmitters:

- **Monobloc:** electronics inside the reactor building
- **Bibloc:** electronics deported outside the reactor building



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Example of SAMS & PAMS



CONCLUSION

Solutions are adapted to each plant:

- **Regulations**
- **Site & VVER specificities**
- **Compatibility with existing systems & sensors**

→ **Need of:**

- **Requirement analysis Method**
- **Flexible and modular system**
- **Hardened instrumentation**

Questions?

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