Видение и опыт Rolls-Royce прохождения процедур сертификации и лицензирования на рынке АСУ ТП АЭС

Experience of Rolls-Royce on VVER Safety I&C

Jana Kubinova – Customer Business Manager

Atomex 2018

03 December 2018

Licensing and certification

We rely on Spinline™ a validated safety I&C technology by Safety Authorities worldwide

Example:

NRC Spinline qualification approval report

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 8, 2014

Rolls-Royce
Attention: Mark Burzynski
I&C Licensing Manager
5959 Shallowford Road, Suite 511
Chattanooga, TN 37421

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION APPROVAL LETTER FOR SPINLINE 3 DIGITAL SAFETY INSTRUMENTATION AND CONTROL PLATFORM TOPICAL REPORT (TAC NO. ME3600)

Dear Mr. Burzynski:

By letters dated July, 8, 2009 (Agencywide Documents Access and Management System (ADAMS) No. ML092160018), January 31, 2011 (ADAMS Accession No. ML110310577), and December 18, 2012 (ADAMS Accession No.: ML13003A319), Rolls Royce Civil Nuclear - Société par Action Simplifiée (RRCN) submitted a licensing topical report (LTR), "SPINLINE 3 Digital Safety I&C [Instrumentation and Control] Platform." By letter dated March 10, 2014, a U.S. Nuclear Regulatory Commission (NRC) draft safety evaluation (SE) regarding our approval of the SPINLINE topical report (TR) was provided for your review and comment (ADAMS Accession No.ML13350A012).

By letter dated April 12, 2014, ADAMS Accession No. :ML14107A180, RRCN commented on the draft SE. The NRC staff's disposition of comments on the draft SEs can be found at ADAMS Accession Nos. ML14143A261.

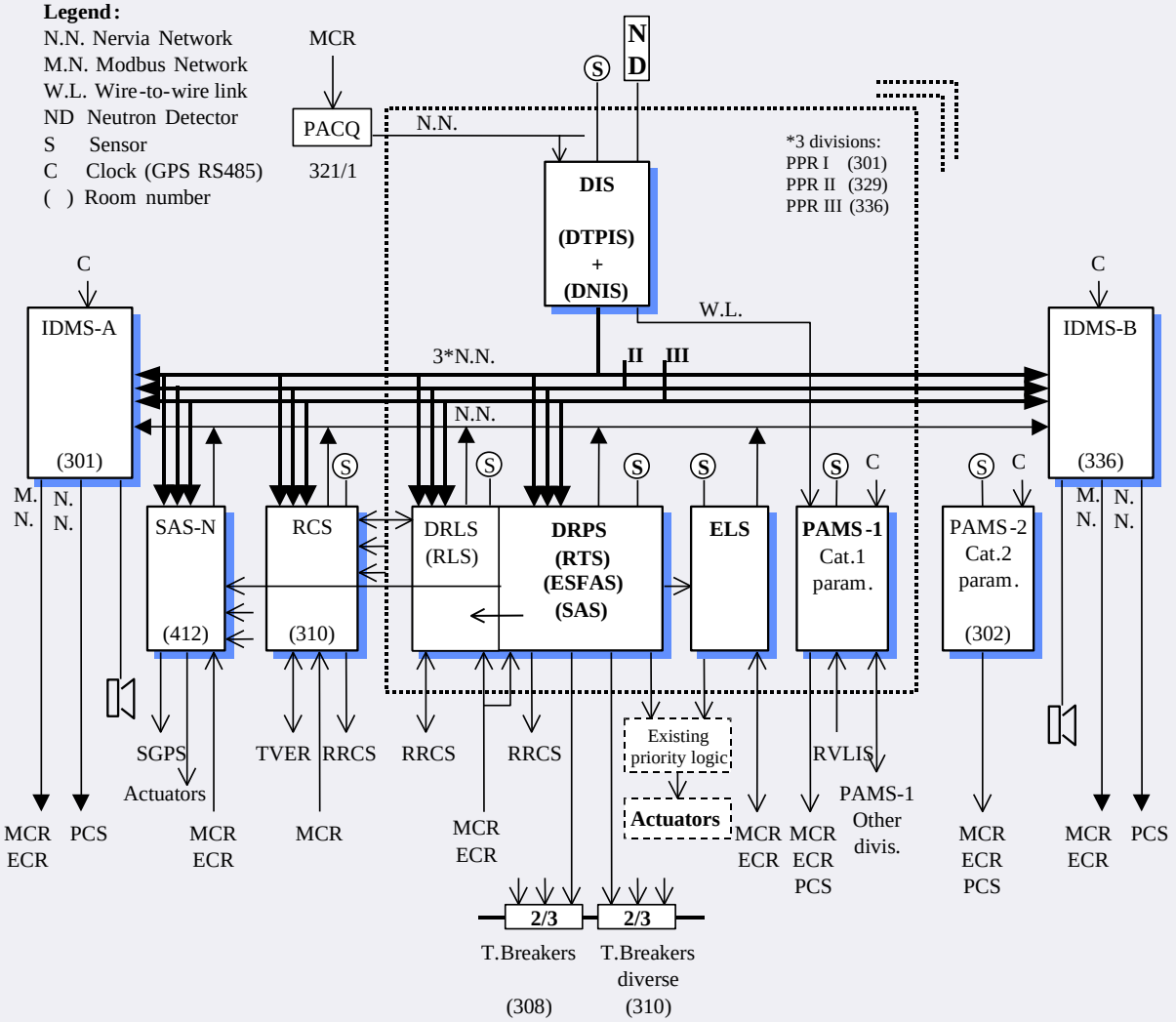
Based on its review of the information submitted by RRCN, the NRC staff finds the TR acceptable for referencing subject to the limitations specified in the TR and in the NRC SE. The final SE defines the basis for our acceptance of the TR.

Content

- Two examples of successful licensing and certification of VVER safety I&C Modernisation Projects
  - DUKOVANY I&C Modernization Project
  - LOVIISA I&C Modernization Project
- Conclusion

Dukovany I&C modernisation

Scope of modernisation



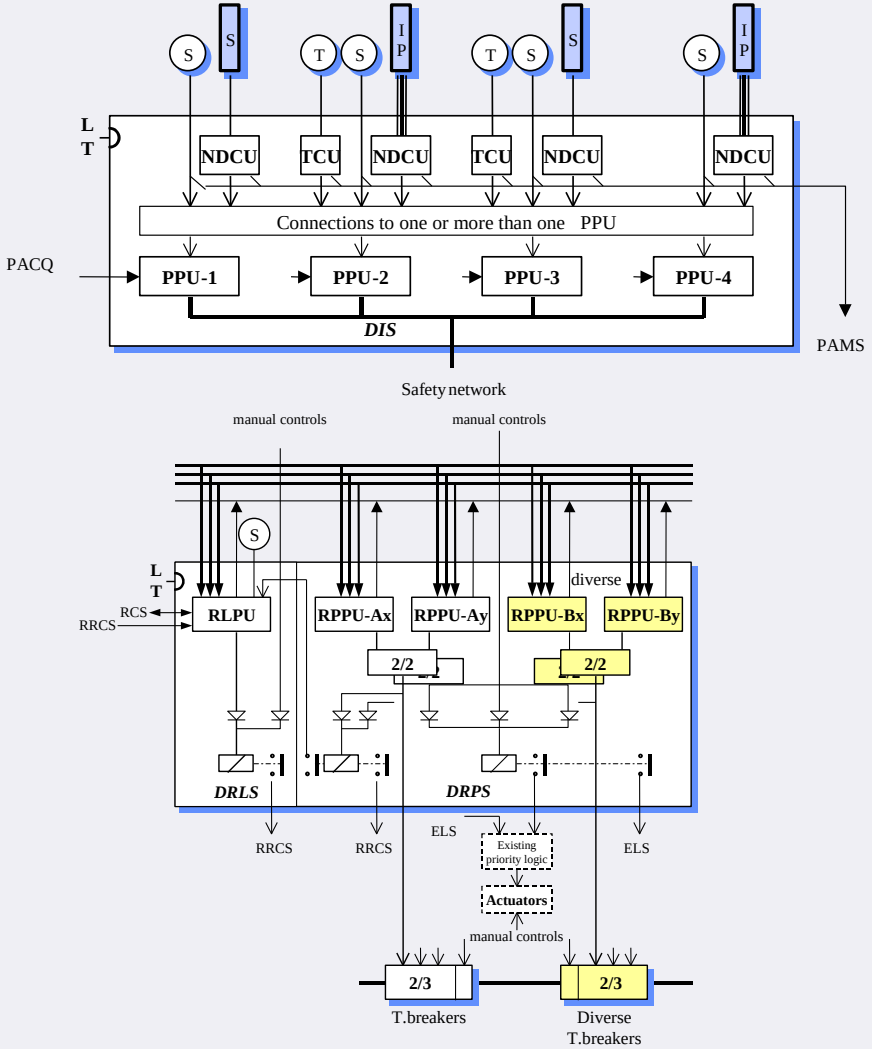
Dukovany I&C modernisation

Main design features

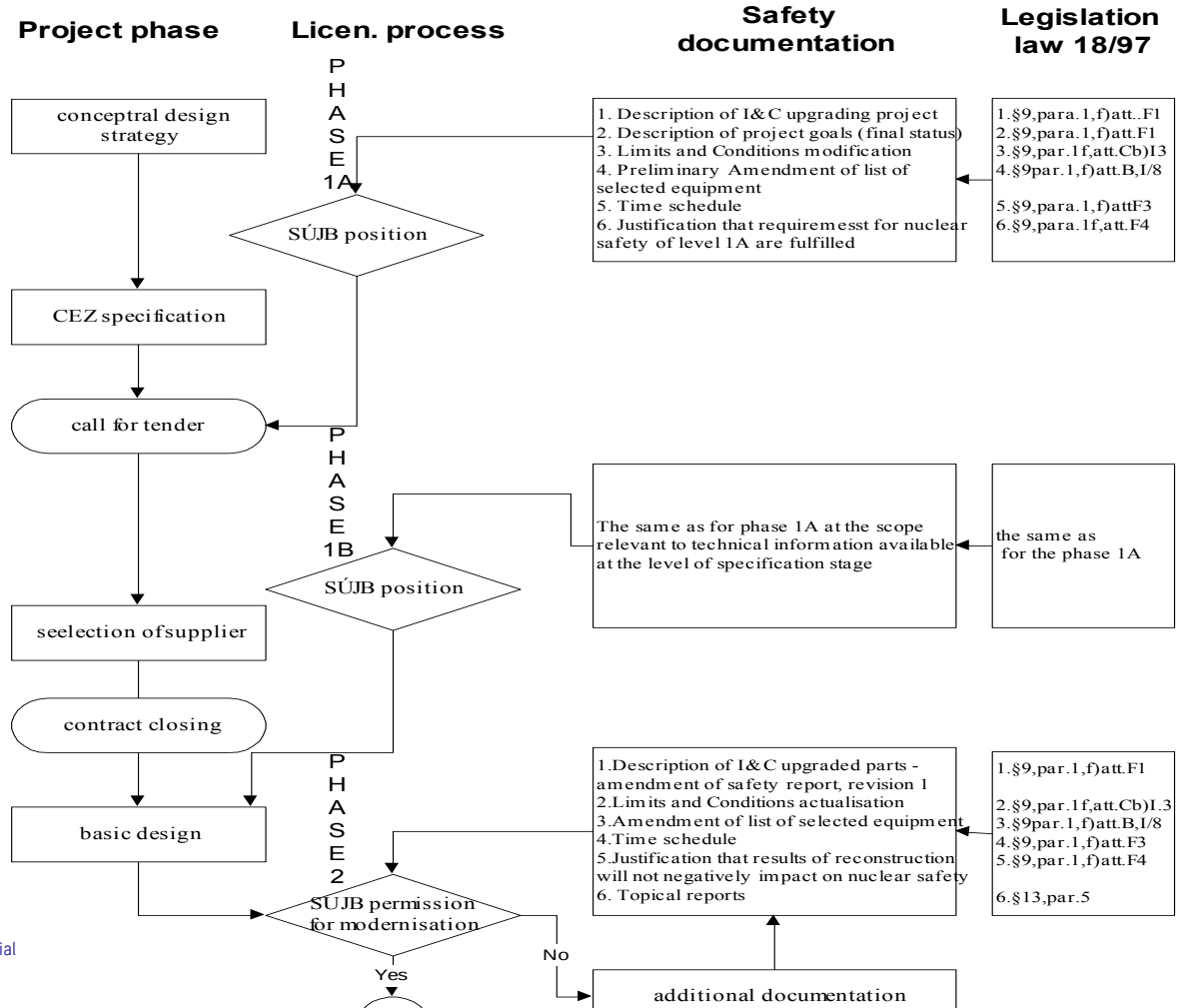
- **Compliance with a wide range of applicable Rules and Standards**
  - International (IAEA, IEC), US (IEEE, NUREG, RG), Czech (Nuclear Law, CSN), SUJB (Czech Safety Authority) Standpoints on selected topics
- **Nuclear InstrumentationTechnology**
  - Optimisation of Neutron Flux Instrumentation thanks to performance (range and sensitivity) of Rolls-Royce products: 2 types of sensors (source range and power range) to cover the whole range (from refuelling up to power operation and post-accidental situation)
- **Reactor Protection System Architecture**
  - Rolls-Royce experience in Digital RPS (design, manufacturing, licensing) on French PWRs has led to a simple, reliable and cost effective solution:
    - The original 3 fold redundant VVER440 structure is kept,
    - Common sensors between RT and ESFAS,
    - Implementation of a two « Lines of Protection » in different and separate units in order to avoid Common Cause Failures,
- **Functional improvements**
  - Deletion of AZ2 and improvements of some functions according to CEZ specification

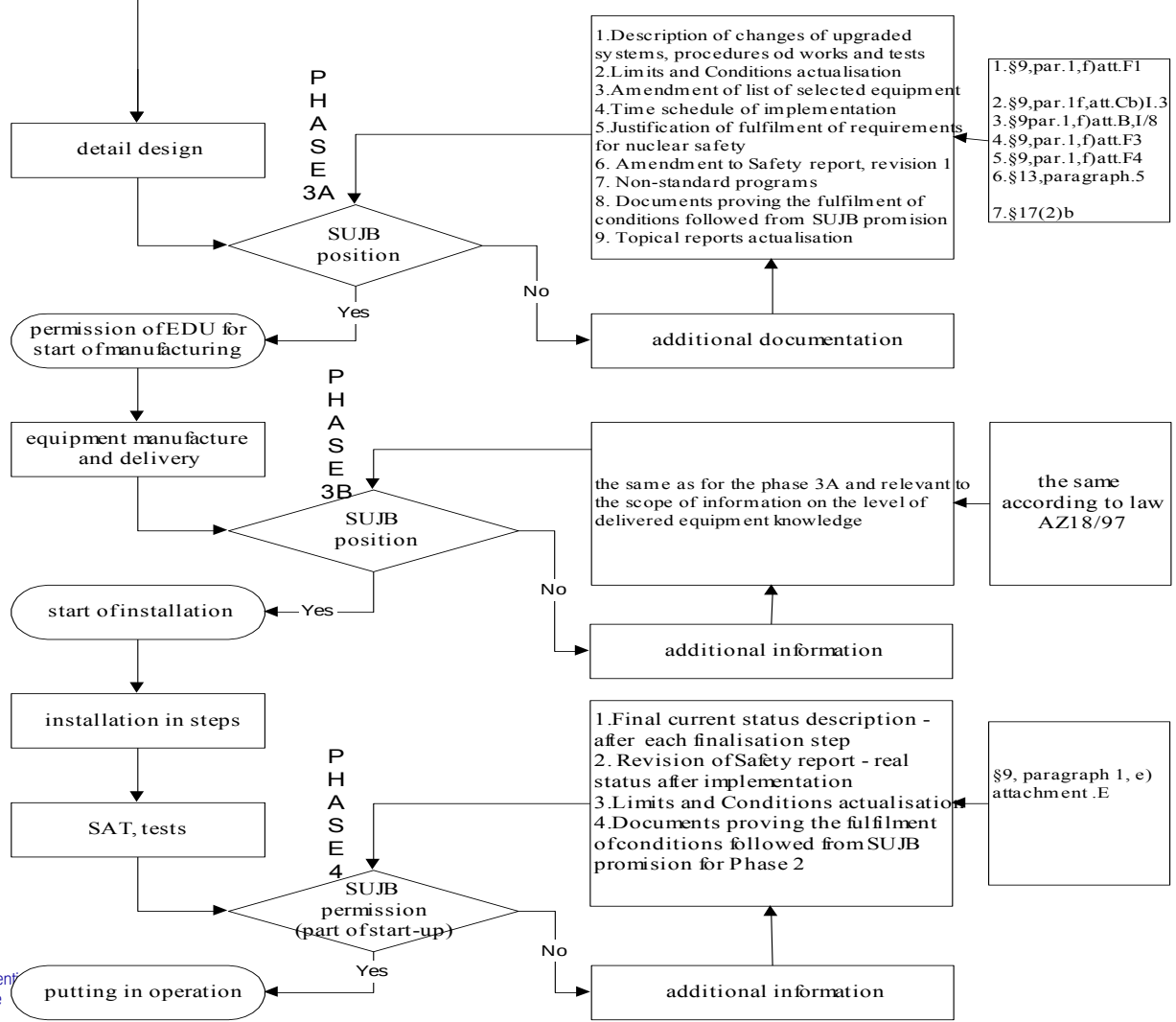
Dukovany I&C modernisation

RPS architecture



Project licensing



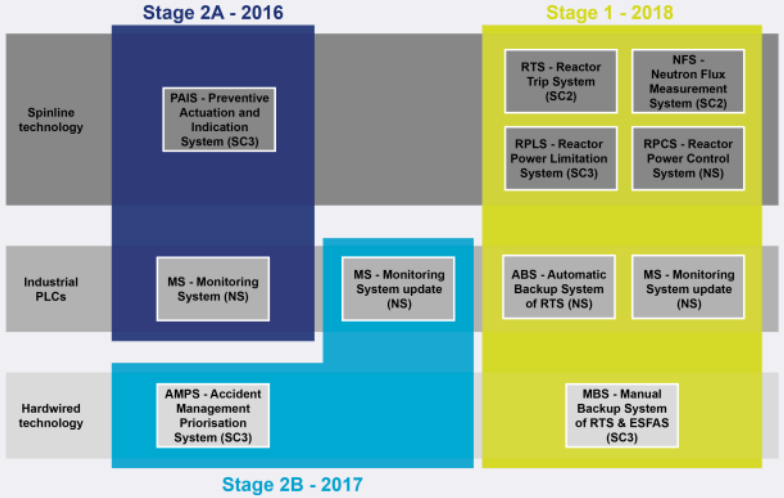


Loviisa I&C modernisation

Scope

From overall I&C support to field engineering and site installation.

- RPS (except ESFAS) was of original Russian technologies ; ageing and spare parts were an issue
- Some safety enhancement were required by STUK and by updated accident analyses



Loviisa I&C modernisation

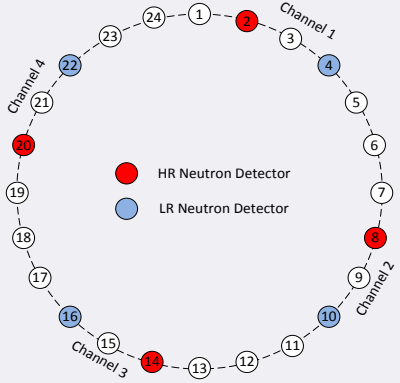
Main design features

- **Compliance with a wide range of Rules and Standards**
  - International (IAEA, IEC), National (SFS), Specific Finnish Rules (YVL Guides)
  - Certification of Spinline platform by TÜV Rheinland ISTec GmbH

- **System Architecture**
  - The original Russian-designed field typically based on the 6 loops is usually distributed in 2 sets of 3 in the original I&C.
  - The German standard is to use 4 fold-redundant safety I&C systems to fulfill single failure tolerance also during possible maintenance and enhance probabilistic approach resistance (already done for original Loviisa ESFAS from Siemens).
  - Interfacing the original Russian-designed field with western (French/German PWR) I&C has been dealt with in Loviisa from the beginning and it is no showstopper.

- **Nuclear Instrumentation**
  - According to the new 4 fold redundant architecture and to the high level of performances of the Rolls-Royce neutron flux instrumentation system, the number of sensors has been reduced (4 power level, 4 source level).

- **Some other specific modifications**
  - Replacement of AKNP by NFS, AZ1 by RTS, ROM by RPLS, ARM by RPCS
  - Safety enhancements in PAIS and AMPS
  - RTS diverse backups in ABS and MBS



TUF Inspection Certificate

Inspection Certificate

Inspection certificate regarding Type Approval based on the assessment of the equipment design and the quality management of manufacturing for the digital safety I&C platform Spinline

Certificate No	968/INS 126.00/15
Client / Certificate Owner	Rolls-Royce Civil Nuclear SAS 23, chemin du Vieux Chêne 38246 Meylan Cedex France
Product	Digital safety I&C platform Spinline to be used for nuclear safety systems (requesting framework: Finnish regulation - ELSA project)
Type designation	Spinline platform software consisting of the following components: - Operational system software (OSS) - Application-oriented library of re-usable software - Software embedded in the NERVIA+ communications board (firmware to implement the communication protocol) and software embedded in the ICTO pulse input board (firmware to implement acquisition of pulses) The detailed list of the Spinline design criteria and of the components of the Spinline platform software is given in the Inspection Report 968/INS 126.00/15
Standards applied for Inspection	IEC 61513:2011 IEC 61508:2009 IEC 60880:2006
Inspection Results	The independent inspection according to ISO/IEC 17020 has been passed successfully without functional remainders. The Spinline platform software is suitable for application in safety systems of nuclear power plants. The Spinline platform design criteria and software comply with the requirements of the standards IEC 61513:2011, IEC 60880:2006 and IEC 61508:2009 regarding its documentation and development life cycle. The detailed assessment results, the assessed documents with the issue date and the software components with the version data can be found in the Inspection Report 968/INS 126.00/15.
Inspection Period	2014-09-12 - 2019-09-15
Validity	The validity of the Spinline digital platform inspection and of the corresponding certificate is limited to five years

Cologne, 2019-09-15

Dipl.-Ing. Heinz Gall

TÜV Rheinland Industrie Service GmbH
Bereich Automation
Funktionale Sicherheit
Am Grauen Stein, 51105 Köln

TUF Inspection report

Inspection Body
Automation - Functional Safety
TÜV Rheinland Industrie Service GmbH

Inspection report regarding Type Approval
based on the assessment of the equipment design
and the quality management of manufacturing
for the digital safety I&C platform Spinline
of the company Rolls-Royce

Report-No.: 968/INS 126.00/16
Date: 2016-09-15