

NRC FOREIGN TRIP REPORT

Traveler, Office, Division, Phone Number:

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Subject:

Participate in an International Cooperative Effort Working Group Meeting related to Vendor Oversight, Paris, France.

Dates of Travel and Countries/Organizations Visited:

November 13 - 18, 2016
Nuclear Energy Agency (NEA) Multinational Design Evaluation Program (MDEP) Vendor Inspection Cooperation Working Group (VICWG)
Paris, France

Desired Outcome:

The purpose of this trip was:

To collaborate in the area of vendor inspection. This meeting facilitated cooperation in the area of vendor inspection and established working relationships between key individuals in the MDEP member countries. The activities of the MDEP VICWG provide insights into the U.S. Nuclear Regulation Commission's (NRC) vendor inspection program based on activities conducted by international nuclear regulatory agencies and supports the leveraging of those activities in support of the NRC oversight of vendors providing parts and services to new reactor construction.

Results Achieved:

The MDEP VICWG continues to achieve its short-term goals of sharing vendor related information between countries and observing inspections when applicable. As the VICWG moves forward, the group will attempt to increase its interaction with the Committee on Nuclear Regulatory Activities (CNRA) Working Group on Inspection Practices (WGIP), continue to plan for one Multinational inspection every two years in addition to continuing joint inspections (multiple nations inspecting to the regulatory requirements of one country), and witnessing of other regulators' inspections.

Summary of Trip:

A brief summary of the MDEP/VICWG meeting is provided below.

This meeting included members from France, Japan, the Republic of Korea, Finland, Canada, China, the Russian Federation, the United Kingdom and the United States. Sweden, United

Arab Emirates, South Africa, India and Turkey were not in attendance. Representatives from the International Atomic Energy Agency (IAEA) and the World Nuclear Association (WNA) were present and made presentations. This was the 18th meeting of this working group.

Regulatory Updates

Members in attendance presented updates on issues. Key issues of interest are described below.

Ms. Hanna Kuivalainen of Finland provided a status of regulatory activities at the Finnish Radiation and Nuclear Safety Authority (STUK). Olkiluoto 3 (OL3), Finland's EPR reactor, is expected to load fuel in April 2018 and first criticality in June 2018. STUK received a construction application for a VVER1200, Fennovoima (FH-1), which is under review. Ms. Kuivalainen reported that there was a valve mix-up during installation at OL3 reactor island. Over 1000 valves are affected with wrong valve bodies, internals, and actuators installed. STUK will be making a CONEX report on the issue.

Mr. Eric Desgagne of Canada discussed current regulatory activities at the Canadian Nuclear Safety Commission (CNSC). CNSC recently issued a new CSA standard, N299, QA Requirements for the Supply of Nuclear Components, which is available on the CSA website. Mr. Desgagne discussed an ongoing investigation on a counterfeit CSA certification on a welding receptacle at Ontario Power Generation (OPG). For this case, it is the sticker on the weld receptacle that is potentially counterfeit.

Mr. Ludovic Battista of France provided an overview of vendor inspection activities and related supply chain regulatory activities by French Nuclear Safety Authority (ASN). ASN discussed the Flamanville (FA3) reactor pressure vessel dome anomalies and associated lessons learned. As a result of the ongoing review, ASN requested the licensee, EDF, to perform non-destructive surface carbon measurements; perform ultrasonic non-destructive tests; conduct fast fracture analysis by calculation; perform a chemical and mechanical test program on mock-ups; and adopt operational compensatory measures, limited to the thermal shock on steam generator channel heads. These activities are required to be complete prior to 5 French reactors restarting. ASN described the documentation irregularities identified by AREVA at Creusot Forge. ASN stated that AREVA's review of all of the Creusot Forge files could take up to two years. ASN has identified one example of the hydro test for a French steam generator with documentation irregularities that could have a significant impact on safety. The ASN led multinational inspection of AREVA Creusot Forge will be conducted the week of November 28, 2016. Regulators from six countries, i.e., France, US, UK, Canada, Finland, and China, will be participating in the inspection.

Mr. Stuart Allen of the UK's Office of Nuclear Regulation (ONR) provided a discussion of ONR's first complete year of its newly established Supply Chain Regulation (SCR) Program. Specifically, ONR commenced vendor inspections (i.e., Costain and Bylor) in February 2016. These vendor inspections focused on examining the adequacy of supply chain management arrangements for compliance with UK regulation, regulatory expectation and specific technical issues. Provisional vendors targeted based on risk, scope and performance. The UK's inaugural plan for 2016/2017 considered a risk baselining review and will inform future vendor inspection plans.

Ms. Olga Kurchatova of the Federal Environmental, Industrial and Nuclear Supervision Service of Russia (ROSTECHNADZOR) described changes to the Rostechnadzor regulations in the

area of atomic energy use since 2015 and 2016. While the changes were not considered significant, they dealt operating organization requirements and deterministic and probabilistic safety analyses. Ms. Kurchatova also described ROSTECHNADZOR documentation associated with their vendor inspections. Specifically, the result of an inspection of a manufacturer is a completed quality plan which is subsequently forwarded to the nuclear power plant site with a set of accompanying documentation. The accompanying documentation includes 1) a review of the results of design documentation review; 2) statement on the manufacturer's preparedness for equipment production; 3) control notification/conclusion; 4) acceptance inspection notification/conclusion; 5) non-conformity reports; and 6) plan of corrective measures with indication of their implementation.

Mr. Hyunsop Chang of the Korea Institute of Nuclear Safety (KINS) provided an update on licensing and construction in South Korea. During startup testing at Shin Kori (either unit 3 or 4), the unit developed a primary power rate to secondary power rate mismatch. Based on the new political party in the Korean congress, Mr. Chang speculated that either Shin Hanul Units 3 and 4 or Shin Kori Units 5 and 6 may be the last new builds due the anti-nuclear position in congress. KINS plans to increase its inspection sample to 10% of its vendors; i.e., 50 inspections, in 2017. However, due to inspector resources available, it is not likely that KINS will reach that goal.

Mr. Yusuke Kasagawa of the Nuclear Regulation Authority (NRA), Japan provided an update NRA's activities related to the carbon segregation issues identified in France. NRA has conducted interviews with Japan Casting & Forging Corporation (JCFC), Mitsubishi Heavy Industry (MHI), and its major utilities to get a better understanding of the carbon segregation issues. Japan Steel Works (JSW) has not come under scrutiny because its forging materials are free of positive macro-segregation zones, according to an ASN report. NRA is reviewing the utilities reported results of their investigations into the possibility of carbon segregation in Japan. Mr. Kasagawa provided the Japanese ordinance and standards for class 1 materials.

Mr. Ding Yihang and Mr. Hu Anzhong of the Chinese National Nuclear Security Administration (NNSA) presented the NNSA vendor inspection program. NNSA licenses their vendors of nuclear safety class equipment design, manufacture, installation, and non-destructive examination services. NNSA, specifically the Northern Regional Office (NRO), also inspects nuclear safety equipment activities both foreign and domestic. NRO also performs nuclear safety culture inspections. Five vendors received this inspection in 2016.

Meeting Details

The group reviewed updated tables for inspections conducted under the VICWG protocol and planned inspections for 2017 were discussed. NRC, KINS, ASN, and ONR representatives provided details of their planned inspections for 2017 to help members identify inspections they would like to participate in or receive information on the outcome. NNSA will provide planned inspections for 2017 when it is released.

The group discussed the results of the MDEP Steering Technical Committee (STC) proposal for the future of VICWG presented by the NEA Technical Secretariat. The Policy Group of the STC decided that it will consider the future transfer of VICWG activities to CNRA when the VICWG activities no longer support design-specific work or when the MDEP framework concludes, currently scheduled for 2022. The group will continue to concentrate VICWG activities on vendor inspection cooperation. In performing this activity, VICWG will share experience and lessons learned to enable the representative to respond to areas of emerging risk (i.e., CFSI, Reverse

Engineering). The group also discussed recommendations for the vendor inspection session of the MDEP workshop in Paris, France in September 2017.

Mr. Tim Kobetz of IAEA made a presentation on the recent changes in IAEA standards. GR3 is now GS Part 2, "Leadership and Management for Safety." Additionally, NP-T-3.26 replaced the old TECDOC 1169. The NRC took an action to work with NEA to invite the DOE representative to our April meeting to discuss NP-T-3.26.

Mr. Greg Kaser of WNA discussed the lasted activities of the Cooperation in Reactor Design, Evaluation, and Licensing (CORDEL) and the WNA Supply Chain Working Group. Made up of approximately 170 members of vendors and licensees, WNA works with the industry to standardize design and licensing. CORDEL promotes the deployment of standardized nuclear reactor design whereas the Supply Chain WG supports the nuclear industry in resolving common challenges in the supply chain and monitoring and identifying market trends.

The next meeting of the VICWG will be in Washington, DC, the week of April 4 – 6, 2017 with a visit to Curtiss-Wright EMD in Cheswick, PA on April 7, 2017.

Pending Actions/Planned Next Steps for the NRC:

NRC is the current vice Chair for the VICWG. NRC will continue to participate in Multinational, Joint and Observed inspections. The NRC shared its currently identified inspections and offered them for MDEP participation and is soliciting support for these activities. The NRC committed to sharing its safety culture assessor qualification program, i.e. IMC 1245, Appendix C12, Safety Culture Assessor Training and Qualification Journal, to the members of VICWG. The NRC has committed to participate in the multinational inspection led by ASN at Creusot Forge the week of November 28, 2016.

Points for Commission Consideration/Items of Interest:

The content of this report is likely to be of interest to the Commission.

"On the Margins":

Members of the six countries scheduled to participate in the MDEP VICWG inspection of Creusot Forge had two separate meetings to discuss logistics and inspection planning. The six participating countries include representatives from ASN, ONR, STUK, NNSA, CNCS, and NRC.

Attachments:

None

NRC INTERNATIONAL TRAVEL TRIP REPORT

Traveler, Office, Division, Phone Number:

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Subject:

Trip Report – Joint Multinational Design Evaluation Programme (MDEP) Inspection at AREVA Nuclear Products (NP) Creusot Forge

Date of Travel and Countries/Organizations Visited:

November 28 – December 2, 2016

Le Creusot, France - AREVA NP Creusot Forge

Desired Outcome:

The objectives of this MDEP Multinational Vendor Inspection (MVI) was to evaluate the ability of ACF to ensure that the forgings delivered comply with the applicable requirements, related to:

- ACF manufacturing processes;
- ACF Quality Assurance (QA)/Quality Management (QM) system;
- AREVA NP's oversight of ACF activities.

Results Achieved:

The MDEP MVI of ACF and AREVA's oversight of ACF activities was completed in accordance with the ASN (Nuclear Safety Authority - France). The results of the inspection were exited with ACF and AREVA NP oversight on December 2, 2016. ASN will issue a publicly available letter documenting the inspection a few weeks from the exit date.

Summary of Trip:

Two NRC (Nuclear Regulatory Commission – USA) inspectors participated in a Joint Multinational Design Evaluation Programme (MDEP) Inspection at AREVA Nuclear Products (NP) Creusot

Forge facility (ACF). MDEP performs Multinational Vendor Inspection (MVI) at facilities that provide products for nuclear plants in multiple nations. MDEP vendor inspections are performed to maximize results obtained from regulators' efforts in inspecting vendors; and to explore opportunities for international harmonization in the area of quality assurance and quality management codes and standards.

The MDEP MVI of ACF and AREVA's oversight of ACF activities was completed in accordance with the ASN direction. The inspection consisted of listening to presentations by ACF and AREVA NP on the ACF manufacturing processes, ACF Quality Assurance (QA)/Quality Management (QM) system, and AREVA NP's oversight of ACF activities. The MVI inspectors also reviewed limited associated documentation. The MVI inspectors conducted interviews of ACF and AREVA NP personnel, walked down the ACF manufacturing shop, and observed forging operations.

The MDEP MVI team consisted of 3 ASN inspectors, 2 ONR (Office for Nuclear Regulation, United Kingdom) inspectors, 2 NNSA (National Nuclear Safety Administration, China) inspectors, 2 NRC inspectors, 1 CNSC (Canadian Nuclear Safety Commission, Canada) inspector, and 1 STUK (Radiation and Nuclear Safety Authority, Finland) inspector. The MDEP MVI team provided a daily debrief to ACF and AREVA NP and exited with ACF and AREVA NP oversight on December 2, 2016.

Attachments:

The ASN public letter will be attached or a link provided after it is issued.

France regulatory update MDEP VICWG 18th meeting



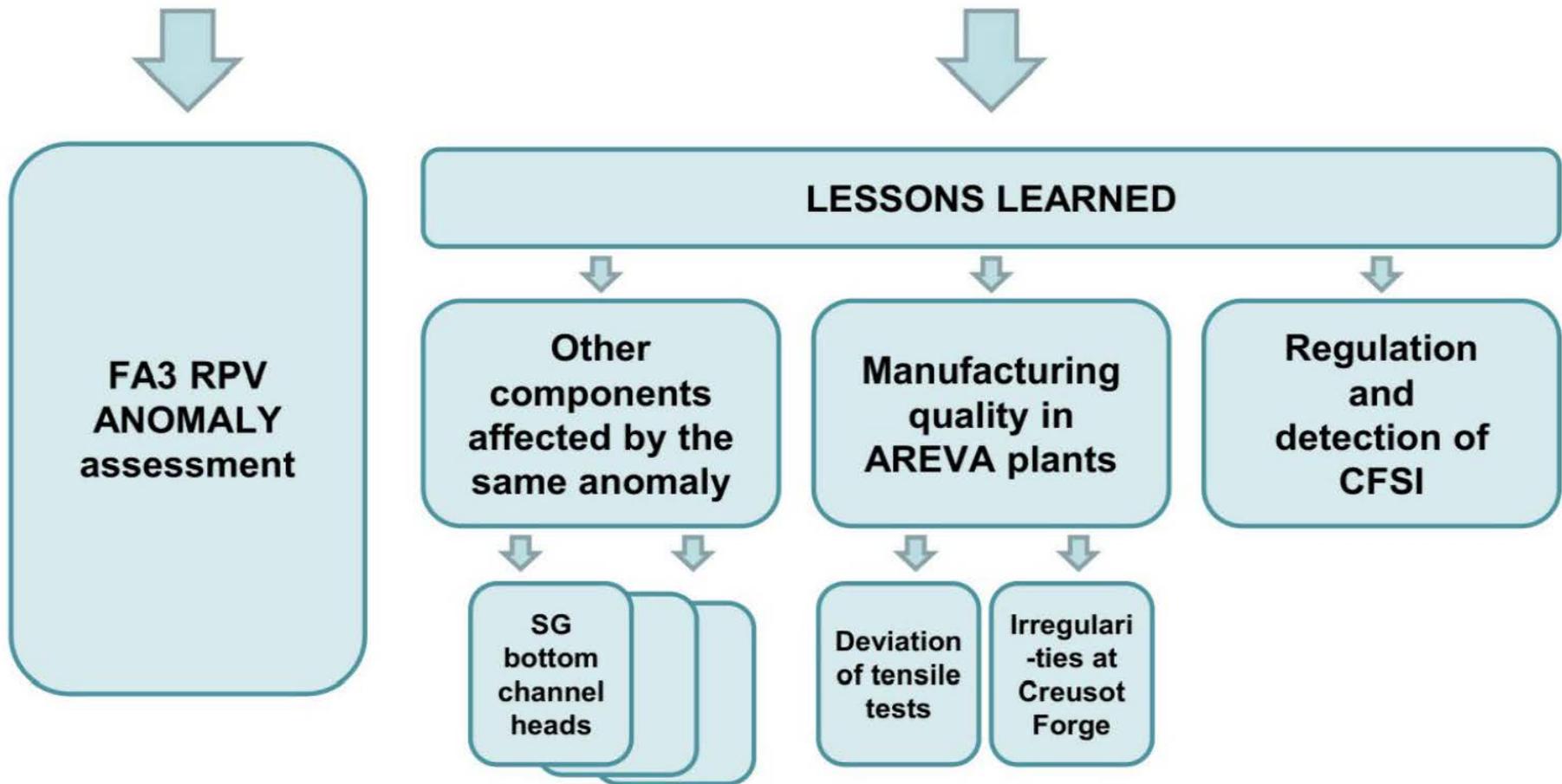
*ASN – French Nuclear Safety Authority
Nuclear Pressure Equipment Department*

- Overview of vendor inspection activities or related supply chain regulatory activity
- Key findings and regulatory issues related to vendor or supply chain activity
- Vendor inspection cooperation opportunities

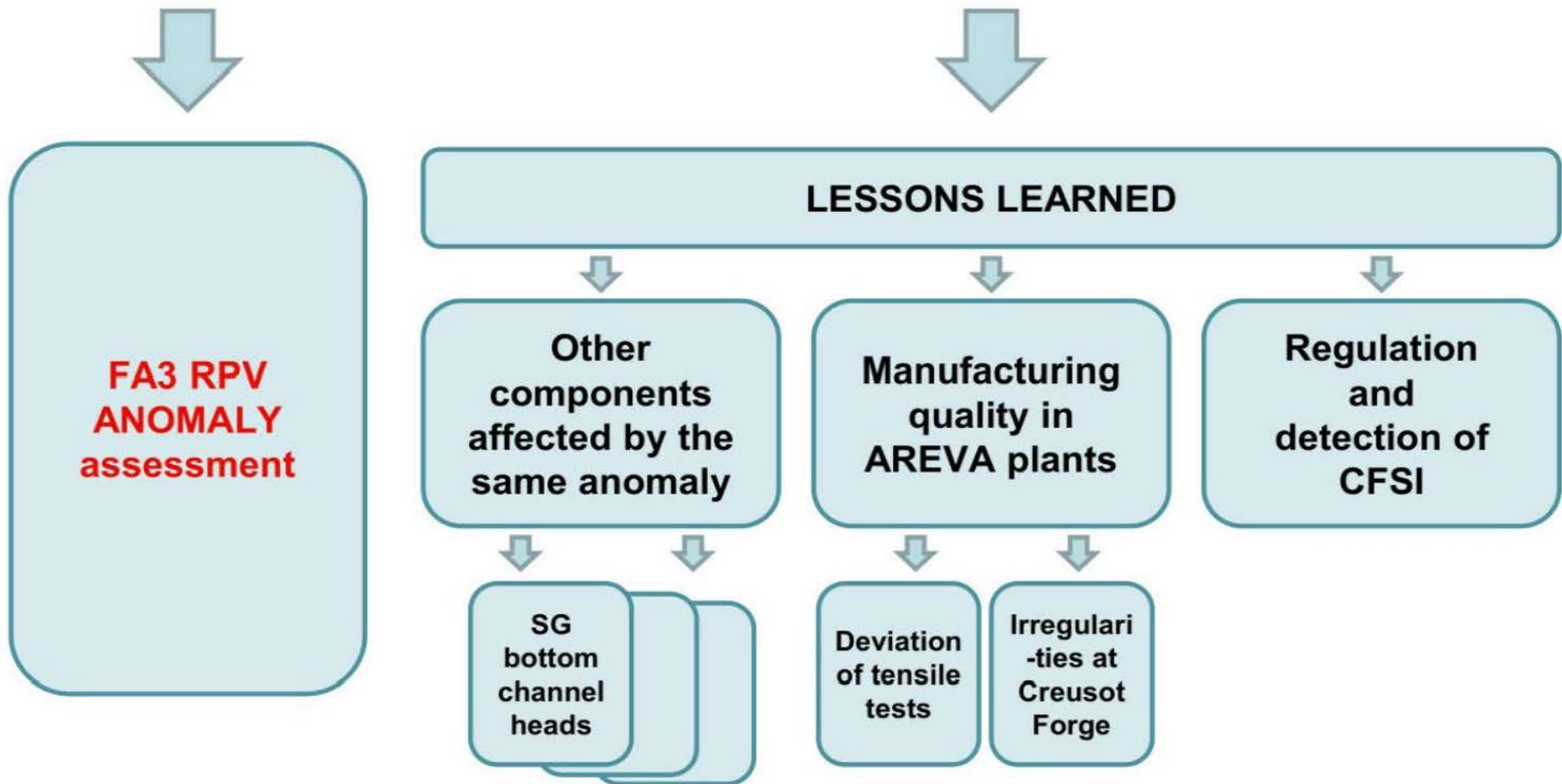


- Overview of vendor inspection activities or related supply chain regulatory activity
 - EPR-FA3 RPV domes segregation anomalies
 - SG channel heads segregation anomalies
 - Deviations during tensile testing
 - Irregularities at Creusot Forge
- Key findings and regulatory issues related to vendor or supply chain activity
- Vendor inspection cooperation opportunities

End of 2014: Detection of anomalies in the chemical composition and mechanical properties in certain zones of the RPV domes



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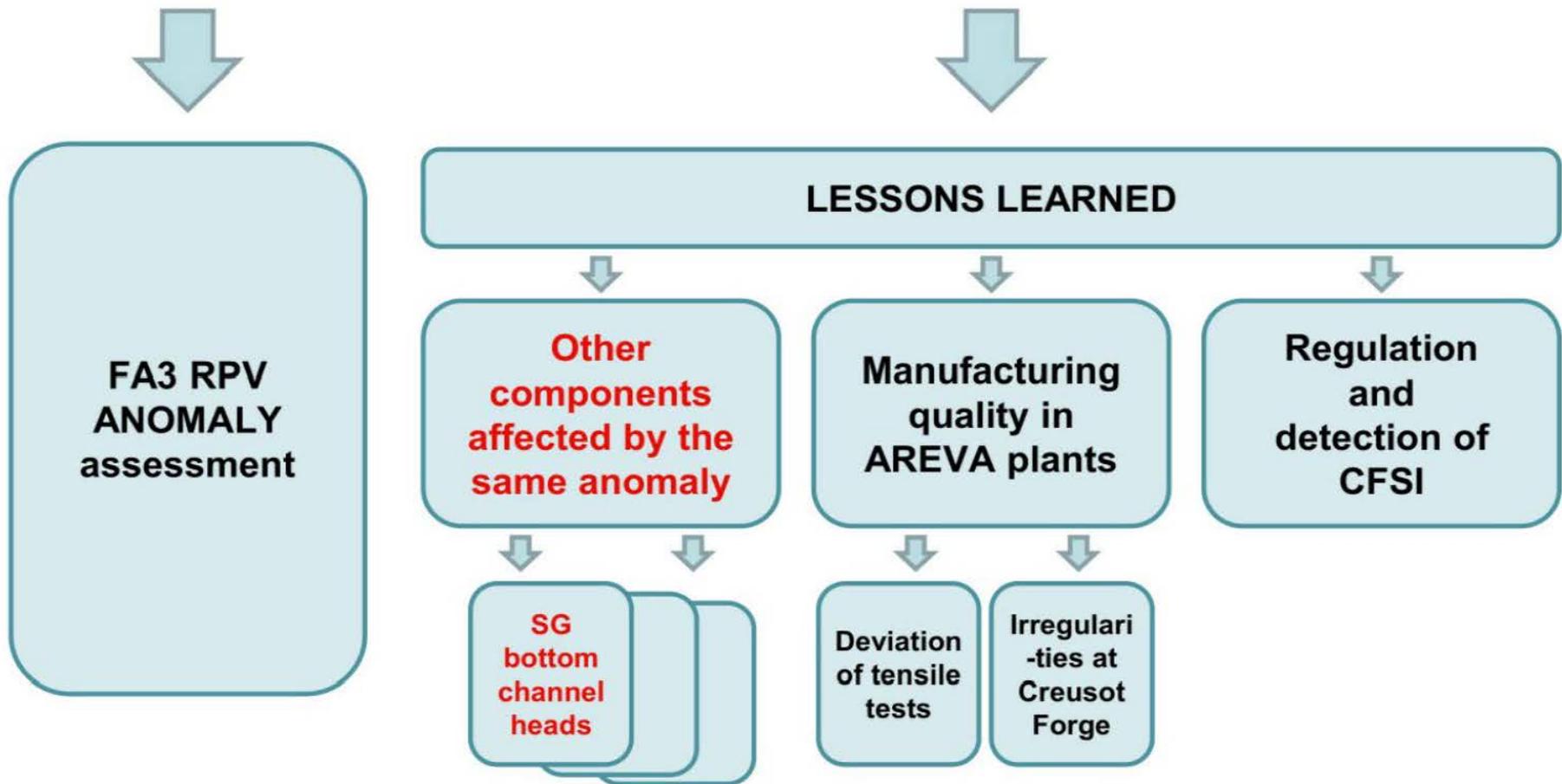
- April 30th, 2015
AREVA submitted its approach to demonstrate the adequate toughness of the RPV domes
- Assessment report by ASN & IRSN [link](#)
- September 30th, 2015 :
Advisory Committee of Experts for nuclear pressure equipment including observers (civil society, foreign regulators)
- Public release of the opinion of the Advisory Committee of Experts for nuclear pressure equipment [link](#)
- December 14th, 2015
Position statement of ASN on the approach proposed by AREVA [link](#)



- **Modification** of AREVA's approach
- Interim Review report by ASN & IRSN [link](#)
- June 24th, 2016 :
Advisory Committee of Experts for nuclear pressure equipment including observers (civil society)
- September 26th, 2016
Position statement of ASN on the modified approach proposed by AREVA [link](#)
- End of 2016 : AREVA expects to submit its conclusion to ASN

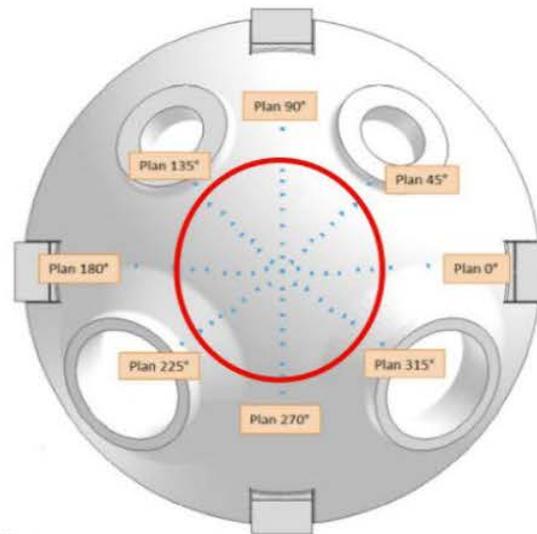


End of 2014: Detection of anomalies in the chemical composition and mechanical properties in certain zones of the RPV domes



- **SG channel heads :**
Creusot Forge and J.C.F.C¹ forgings
(18 PWRs in France)

- Review by EdF of the manufacturing process and carbon tests during manufacturing
- High risk of carbon segregation in the central region and in the nozzles
- Risk: Fast fracture

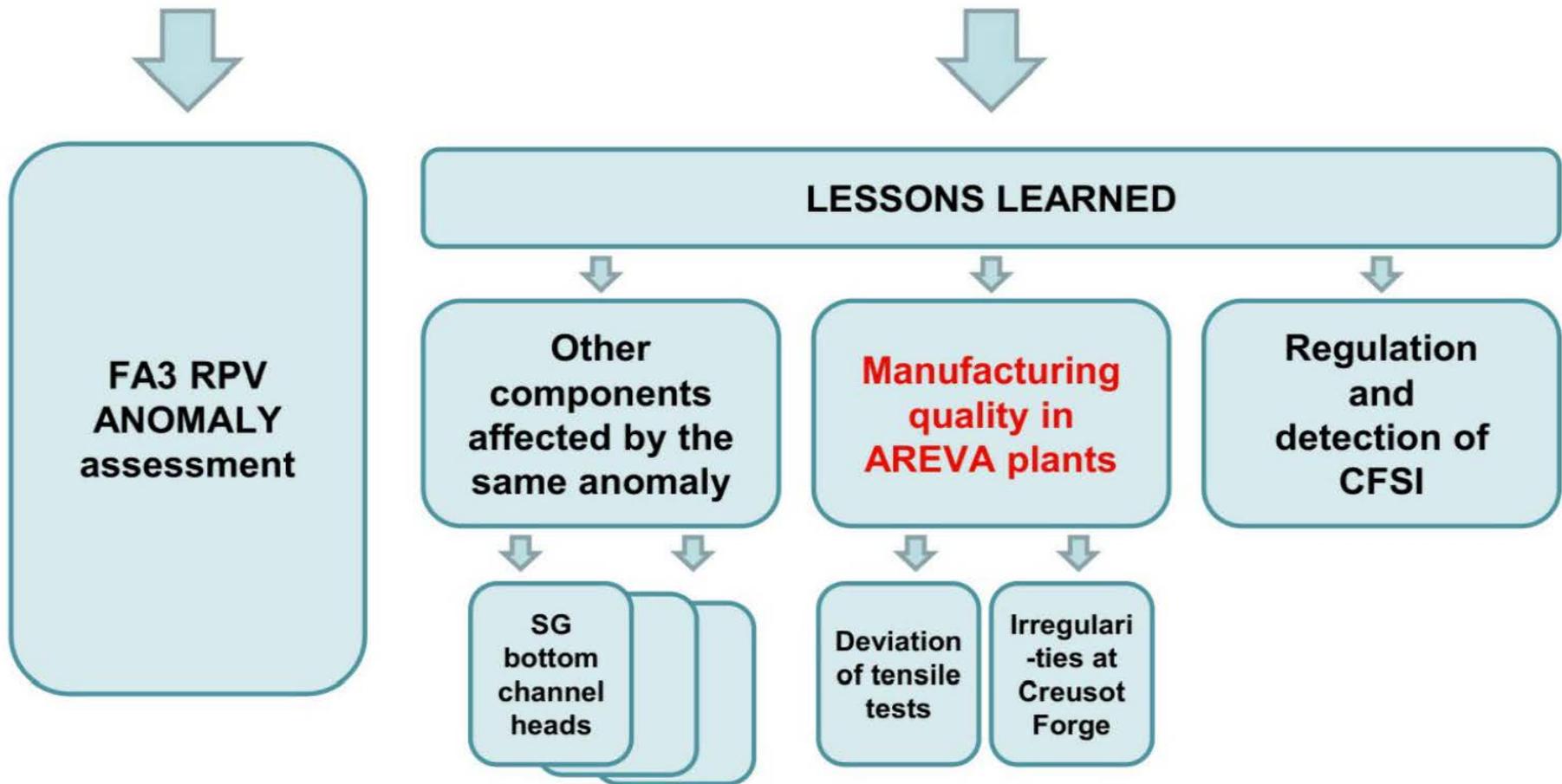


¹ Japan Casting and Forging Corporation

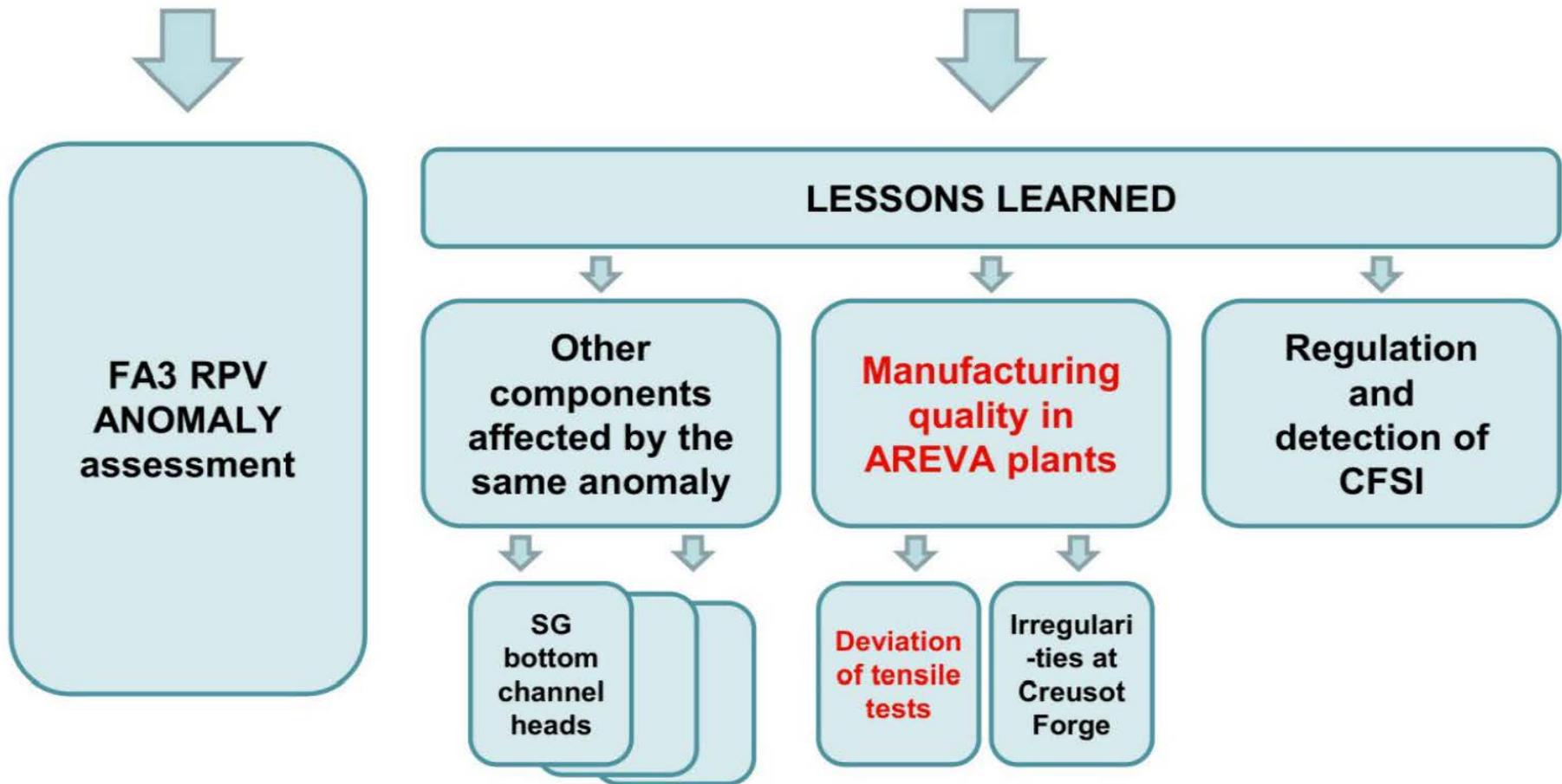


- **ASN requested EDF to:**
 - perform non-destructive surface carbon measurements
 - perform ultrasonic non-destructive tests
 - conduct fast fracture analysis by calculation
 - perform a chemical and mechanical test program on mock-ups
 - adopt operational compensatory measures (limitation of the thermal shocks on SG channel heads)
- **ASN takes position before the restarting of each reactor**
 - > 5 reactors to be shut down within 3 months to carry out tests [link](#)
- **These technical anomalies raise questions towards the consistency of historical industrial nuclear codes**

End of 2014: Detection of anomalies in the chemical composition and mechanical properties in certain zones of the RPV domes



End of 2014: Detection of anomalies in the chemical composition and mechanical properties in certain zones of the RPV domes



- **Detection of uncontrolled testing rate* measurements**

- **What**

- failure of instruments to measure strain rate* (e.g. extensometers)
- and/or deviation of applied stress rate*

- **Where**

- at AREVA Creusot Forge laboratory
- at other manufacturers laboratories
- at independent ISO-17025 accredited laboratories

- **How**

- by reviewing test records and diagrams
- by live monitoring of testing rate

- **Consequence**

- overestimation of tensile mechanical properties of the material tested

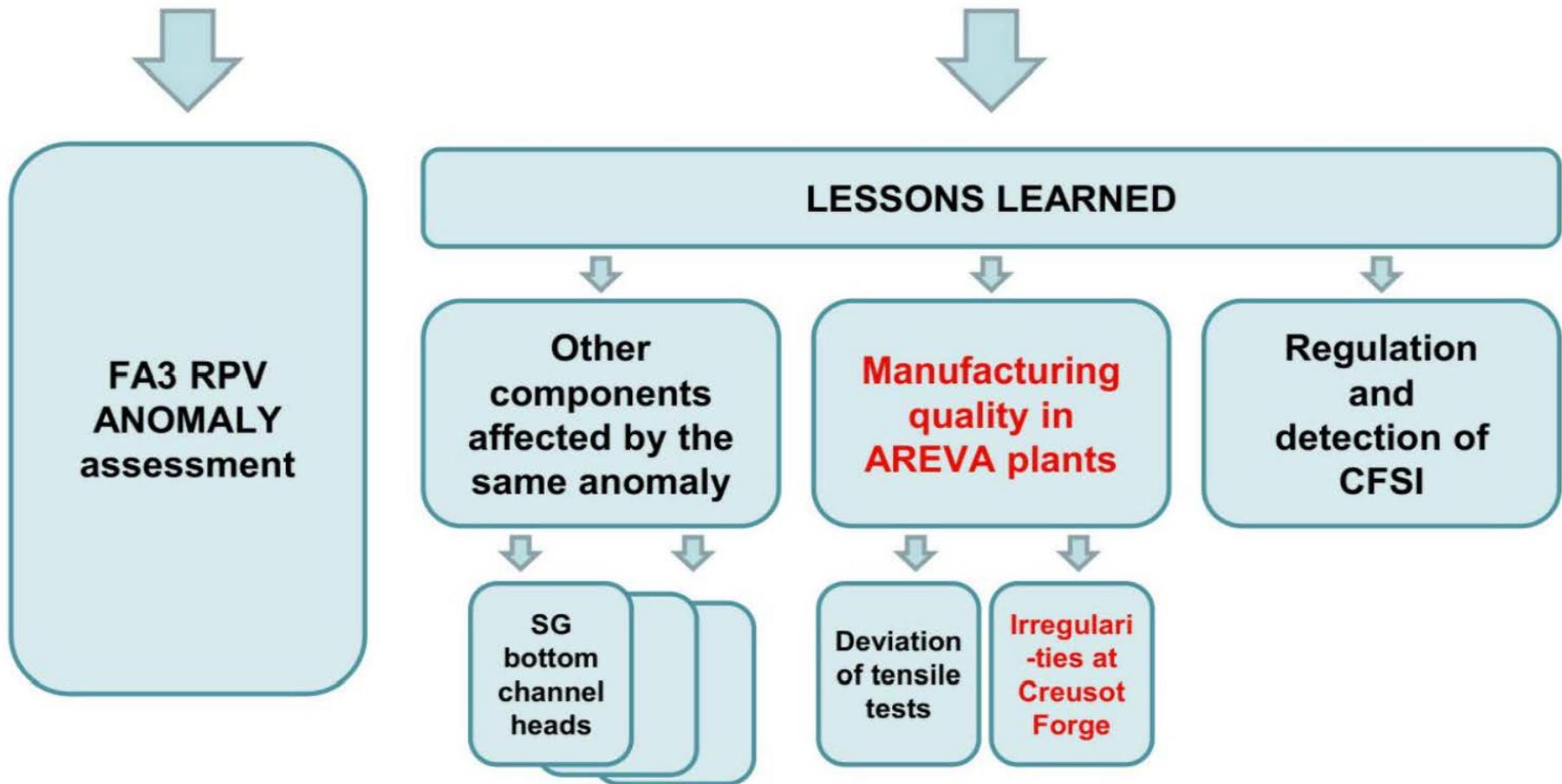
- **Preventive actions**

- monitor testing rates
- save testing records for review

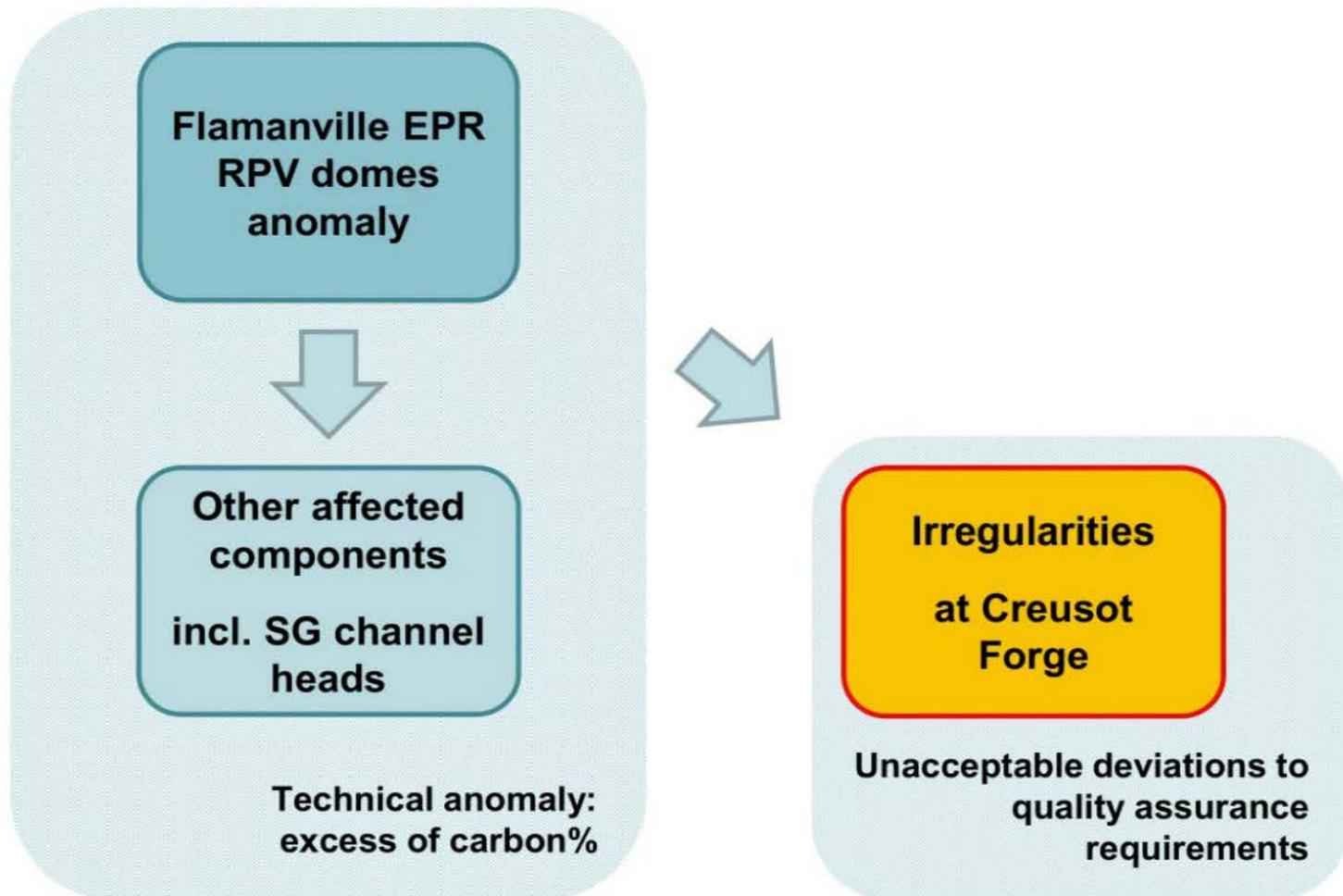


* As defined in the EN ISO-6892

End of 2014: Detection of anomalies in the chemical composition and mechanical properties in certain zones of the RPV domes



Technical anomaly ≠ irregularity





Irregularities at Creusot Forge

- End of 2014 :
detection of an anomaly on the Flamanville EPR RPV domes
- April 2015 :
at the instigation of ASN, AREVA initiates a quality review of the past manufacturing in its Creusot Forge plant
- April 25th, 2016 :
AREVA informs ASN of irregularities in the manufacturing of 400 nuclear parts produced since 1965 (strikethrough files) [link](#)
- September 23th 2016 :
AREVA completes a first review of strikethrough files and ASN publishes the list of 87 cases impacting the French nuclear fleet [link](#)
- October 2016 :
AREVA announces the review of 6,000 nuclear manufacturing reports will begin after detection of irregularities in “non-strikethrough” files

- **Irregularities =**

- Inconsistencies, modifications or omissions in the production files, concerning manufacturing parameters or test results
- Historical practice...

- **Impact in French nuclear activities**

- 4 nuclear transport containers
- 24 operated reactors + EPR Flamanville
 - Components impacted : RPV vessels and domes, SG shells and domes, MCL forgings
 - ASN has suspended the hydrotest certificate for a steam generator in Fessenheim NPP

- **ASN's position**

- Unacceptable practices with potential major impact to nuclear safety
- Thorough analysis of all past manufacturing files is necessary
→ additional cases may be detected
- For the last 12 months, 3 cases of CFSI have been notified to ASN :
Regulators, licensees and manufacturers' approach need to evolve to
detect such practices
- Sharing inspection experience and lessons learned at international level



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- Key findings and regulatory issues related to vendor or supply chain activity
- Vendor inspection cooperation opportunities
 - M.V.I. of AREVA NP at Creusot Forge



Multinational Vendor Inspection at Creusot Forge

- **Context**

- Le Creusot (France) 28 Nov. – 2 Dec 2016

- **Objective**

- to evaluate the ability of AREVA NP to control the quality of products forged in its Creusot Forge plant

- **Scope**

- Creusot Forge QA/QM system arrangements following irregularities event
- Control of processes
- Oversight of Creusot Forge activities by AREVA NP

- **VICWG Participants**

- Canada, China, Finland, France, UK, USA

