

Montrouge, 16/11/2021

Letter reference:

CODEP-DCN-2021-044799

For the attention of the Director

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Subject: Monitoring the procurement of equipment for nuclear power plants
Joint MDEP inspection
Vendor FAIRBANKS MORSE DEFENSE, Beloit, USA

Topics: R9.9 Vendors

Code: Inspection INSSN-DCN-2021-0926 of 22/09/2021

References:

- [1] Environment Code, and more specifically chapter VI of title IX of book V
- [2] Environment Code, and more specifically its chapter VII of title V of book V and Article L.593-33
- [3] Order of 7 February 2012 amended, concerning basic nuclear installations
- [4] MDEP VICWG Common position, CP-VICWG-02, "*Common position: witnessed, joint, and multinational vendor inspection protocol*" of 4 November 2020

For the attention of the Director,

As part of the ASN remit concerning the monitoring of the referenced basic nuclear installations, a joint inspection by ASN and the American Nuclear Regulatory Commission (US-NRC) of the vendor FAIRBANKS MORSE DEFENSE was held from 22 to 24 September 2021 on the topic R9.9 "Vendors". ASN inspected FAIRBANKS MORSE DEFENSE in its capacity as an EDF vendor.

Pleased find below the summary of the inspection, along with the main requests and observations arising from the findings made by the inspectors on this occasion.

Inspection summary

The joint inspection carried out in accordance with the protocol of the MDEP (*Multinational Design Evaluation Program*) of the Nuclear Energy Agency (NEA) in reference [4], took place between 22 and 24 September 2021. This inspection concerned the steps taken by your vendor FAIRBANKS MORSE DEFENSE to comply with the requirements associated with the manufacture of the ultimate back-up diesel generator sets (DUS) intended for nuclear power plants.

In the light of this examination based on spot-checks, the organisation defined and implemented by your vendor is good with regard to the manufacture of nuclear equipment.

The inspectors consulted the list of the important activities for the protection (“AIP”)¹. The exhaustiveness, completeness and correct management of this list were considered to be a good practice by the inspectors. The FAIRBANKS list of AIPs thus identifies all the critical activities in the manufacture of the ultimate back-up diesel generator sets (DUS) as well as the corresponding technical controls. Similarly, the critical activities performed by the FAIRBANKS subcontractors are also identified in this list. This list of AIP notably enables it to adapt its subcontractor inspections by calling the vendor to attend and monitor the operations.

The inspectors were also able to note that FAIRBANKS carries out a monthly analysis of all non-conformities, which ensures that operating experience feedback is continuously taken into account. In the event of a non-conformity considered to be important and which could require follow-up or the creation of a corrective action, an “A3 team” process enables dedicated teams to be activated.

Finally, the inspectors carried out spot-checks on the steps taken by FAIRBANKS to monitor its subcontractors and to detect and analyse any non-conformities.

This inspection is the subject of two additional information requests.

A. Corrective action requests

Not applicable.



¹ That is an important activity for the protection regarding the interests mentioned in article L. 593-1 of the Environment Code (security, public health and safety, or protection of nature and the environment).

B. Additional information

B.1 - Ability of ultimate back-up diesel generator sets to withstand water mist

Article 2.2.5 of order [3], paragraph II, states that *“the elements important for protection are subject to qualification proportional to the issues involved, aiming in particular to guarantee the ability of these elements to fulfil their assigned functions, with respect to the stresses and environmental conditions associated with the situations in which they are necessary. Design, construction, tests, inspection and maintenance provisions enable this qualification to be maintained for as long as necessary.”*

EDF found outbreaks of fire and significant and recurring releases of smoke from the exhaust manifolds of the opposed-piston diesel engines equipping the DUS of the 1300 MWe reactors. EDF refers to this phenomenon as “candle fires”.

The inspectors held discussions with the manufacturer FAIRBANKS concerning the representativeness of the qualification tests performed on the ultimate back-up diesel generator sets (DUS). These tests consisted of 1700 repeated start-ups and shutdowns to guarantee the equipment’s reliability over time. The repetition of these short sequences was not such as to create situations which could lead to these releases of smoke or outbreaks of fire.

However, these tests did not include fire spraying which could be triggered by the release of smoke or outbreak of fire, by means of the sprinkler system installed in the room. The inspectors therefore questioned the manufacturer regarding its equipment’s ability to withstand and continue to operate in a water mist, should this fire-fighting system be triggered. FAIRBANKS analysis reports describe the operation of a diesel in a water mist, but these analyses were not presented to the inspectors during the inspection.

Request B1: I would ask you to send me the analysis reports and the conclusions of the vendor with regard to situations in which a FAIRBANKS opposed-piston engine is used in a water mist, such as to guarantee its reliability in these degraded conditions.

B.2 - EDF training of maintenance personnel

The inspectors held discussions with the FAIRBANKS representatives concerning the potential causes of the candle fires.

During its discussions with the users of its engines, the manufacturer identified three main causes of the outbreak of candle fires: the first is excessive pre-lubrication of the diesel (pre-lubrication system in service for more than 3 minutes), the second is failure to turn the engine over between 20 minutes and 1 hour after shutting down the diesel and the last is failure to run-up the diesel at least once a

month to more than 50% power, enabling a minimum temperature of 280°C to be reached. These recommendations are in particular detailed in the operating and maintenance guide (GEE) which was sent to the licensee for maintenance of the opposed-piston FAIRBANKS diesels.

Consequently, several human causes have so far been identified by the Fairbanks Morse Owners Group as being behind these candle fires. The inspectors wanted to ensure that, on the one hand, the personnel carrying out maintenance of these specific diesels have received appropriate training and that, on the other, the manufacturer's recommendations are followed by the licensee in order to reduce the risk of candle fires.

Request B2: I would ask you to ensure that the personnel carrying out the operation and maintenance of opposed-piston diesel engines are sufficiently trained.

Request B3: I would ask you to send me the means implemented and their adaptation to the vendor's recommendations, to prevent the candle fire phenomenon during operation and maintenance of opposed-piston diesels.

You will report to me on the actions taken in reply to requests B2 and B3.



C. Observations

C1. Prevention of risk of Counterfeit, Fraudulent and Suspect Items (CFSI)

The FAIRBANKS subcontractors are audited by a specific team, in particular for the critical activities performed outside the Beloit plant. For the diesels intended for the EDF NPPs, the AIPs were checked directly at the FAIRBANKS vendors.

However, this check did not directly take account of the risk of counterfeit and fraud and did not query the subcontractors regarding the measures adopted to prevent this risk. The inspectors wished to recall the importance of extensive communication to the entire subcontracting chain concerning the risks of fraud and counterfeit (CFSI).



Kindly send me your comments and answers concerning these points within a maximum of **two months**. With regard to the commitments you will be required to make, I ask that you identify them clearly and indicate a completion date for each one.

Yours sincerely,

Signed by:

Director of the Nuclear Power Plants Division

Rémy CATTEAU