

JRC TECHNICAL REPORTS

Quarterly report on NPP events

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Foreword

In the European Union, a regional network, the European Clearinghouse on Operating Experience Feedback for Nuclear Power Plants, has been established to enhance nuclear safety through improvement of the use of lessons learned from operating experience.

The European Clearinghouse is composed mainly of European nuclear safety regulatory authorities and their technical support organisations. It is operated by dedicated staff from the European Commission's Joint Research Centre.

Abstract

This newsletter provides Feedback on Operating Experience (OEF) from significant safety related events at nuclear power plants (NPPs) worldwide, compiling the NPP events that were reported publicly in October - December 2020.

1 Introduction

This newsletter provides Feedback on Operating Experience (OEF) from significant safety related events at nuclear power plants (NPPs) worldwide, every three months. It is intended to provide timely information to the Clearinghouse members about recent significant events, with a real or potential impact on nuclear or radiation safety. The report is intended to be complementary to other international reporting systems such as the International Atomic Energy Agency (IAEA) IRS, rather than duplicate the information provided by them. Usually the information used to prepare the report is publicly available and the information is notified promptly, in advance of other reporting systems. Only events that are considered to be likely to have lessons applicable to EU NPPs are selected.

Event selection for reporting in this newsletter is a two stage process. All the information found on relevant web sites is initially screened and the events that match at least one of the following criteria are short-listed for further consideration:

- Unplanned or unexpected automatic or manual reactor trips;
- Events rated at INES Level 2 or above;
- Significant radiological events;
- Real or potential challenges to nuclear safety or defence in depth; including recurrent events and actuation of systems;
- Events with common cause failure aspects;
- Events with lessons learned worth being disseminated;
- Events requiring the entry into emergency operating procedures

Furthermore, staff may occasionally short-list other events based on other criteria.

The final selection of the events is made by the JRC Clearinghouse Selection Committee. The following criterion is adopted to guide the Committee's final selection:

- Level of actual or potential effect on safety;
- Events rated at INES Level 2 or above; and
- Significance of lessons learned for EU NPPs.

Clearly the criteria above are open to a degree of interpretation and judgment and the selection committee is comprised of suitably qualified and experienced personnel who by applying engineering judgment and through consensus, arrive at the final selection.

Finally, no comparison should be made among countries with regards to the number and significance of events, as the number of nuclear power plants, the reporting criteria and, most significantly, the information made available to the public, varies widely among countries.

2 Events short-listed

Gathering event information for short-listing involves searching potential sources of operating experience information including relevant worldwide websites. When NPP related event reports are identified as potential candidates for the shortlist the information is translated into English, wherever necessary, for the purpose of screening and possible inclusion in this newsletter. The sources of the event information are referred to in an event list compiled for the purposes of screening which then results in the initial short-list.

The short-list of events considered for inclusion in this quarterly report are drawn from NPPs world-wide and can be found in the database on our website, accessible to Clearinghouse members. The following information is collected: title of the event; date of event or date of reporting if date of incident not available; event description; INES level (if available) and name of the NPP.

3 Events selected

Three events were selected from the short-list for this Newsletter:

1. 04/05/2020: Identified substitution of piping components materials (SLOVAKIA / MOCHOVCE 3/4).
2. 20/07/2020: Manual reactor shutdown of two units on decreasing condenser vacuum due to eel grass intrusion (US / BROWNS FERRY 1/2).
3. 12/08/2020: Setpoint drift in main steam line safety relief valves results in three valves inoperable (US / BRUNSWICK 1).

The information provided is extracted from publicly available and other authorised sources. More detailed information on these events may become available in due course, either from the original source or through international operating experience sharing systems.

In addition to these three events, in December 2020 the French operator EdF reported that, as a result of the inspections on the seismic resistance of diesel generators auxiliary systems carried after a previous event (see the newsletter for the first quarter of 2020), similar deviations have been found at other reactor units. In the case of Cruas 3, Cattenom 2, Paluel 2, Penly 1 and Saint Alban 1 the event has been rated as INES 2.

3.1 Identified substitution of piping components materials

MOCHOVCE 3/4 (Units under construction) – 04/05/2020

During the piping post-assembly inspection carried out by a contractor in November 2019 at Unit 4, two small diameter tees at the inlet of the pressuriser's relief tank were found to be made of carbon steel, instead of stainless steel, which was the material required by the design and declared by the parts certificate. The affected parts were replaced immediately.

After this finding, and as an audit of certain vendors supplying piping parts to both units 3 and 4 revealed deficiencies in quality control, a large project has been set up by the operator under close surveillance of the regulator to actually verify the authenticity of the inspection certificates for thousands of parts supplied to the two units, using a graded approach (the depth of control for a part is defined in accordance with the safety relevance of the part). The certificates are checked with the manufacturers and with the legal entities having confirmed the quality and properties of the parts, but as well positive material identification is carried out in parallel using a variety of testing methods (portable X-Ray fluorescence spectrometers, optical emission spectroscopy, laboratory tests of chemical composition, mechanical properties tests, etc.).

No other cases of replacement of high-alloy corrosion-resistant steel by lower grade materials have been identified so far, however the analyses did show in some cases that the material of the installed part is not in conformity with the declared material in the inspection certificate.

Editor's comment – *This event has been highlighted because of the interest of its lessons learned. In particular the graded approach adopted to conduct material verifications of large numbers of parts is a valuable experience that could be of interest for operators and regulators involved in new build projects or in large design modifications at existing units.*

3.2 Manual reactor shutdown of two units on decreasing condenser vacuum due to eel grass intrusion

BROWNS FERRY 1/2 – 20/07/2020

On July 20 the Unit 1 control room received a traveling screen differential pressure high alarm. Assistant Unit Operators dispatched to the condenser circulating water (CCW) system forebay reported large masses of eel grass. The influx of eel grass resulted in fouling of the trash racks and traveling water screens for all three units which reduced the CCW flows during this event.

As a result of degrading condenser vacuum on Unit 2, operators manually scrambled the reactor. Sometime later, as Unit 1 condenser vacuum continued to degrade to the turbine trip setpoint, operators manually scrambled Unit 1 as well. Unit 3 also experienced degraded condenser vacuum but was able to maintain reactor operation at a reduced power of approximately 75 to 80%. The plant responded as designed and all safety systems remained in a standby readiness configuration.

The root cause of the event was that existing permanently installed plant equipment at the forebay was not adequate to mitigate the newly developed threat presented by large scale eel grass accumulation on Wheeler Lake. A contributing cause was that the procedures for risk based decisions were not aligned with industry standards and were not consistently implemented. Indeed, already in 2019 eel grass growth and breakaway resulting in accumulation in the forebay became a new problem for the plant and the generational risk was quickly identified, however the problem reoccurred one year later.

Editor's comment – *The event has been highlighted because of the potential interest of its lessons learned for everyone. Too often risks analyses are conducted, but then ignored or not acted upon, so that operators are later forced to act only when the risk manifests itself.*

3.3 Setpoint drift in main steam line safety relief valves results in three valves inoperable

BRUNSWICK – 12/08/2020

During the spring 2020 Unit 1 refuelling outage, all eleven pilot valve assemblies in the SRVs were replaced with certified spares. The removed SRV pilot valves were sent to an external laboratory to determine the as-found set pressure. The test results, available in August, showed that three of the eleven valves lifted at greater than +3% authorised by the technical specifications. However, the valves always remained capable of performing their safety function of preventing overpressurization of the reactor coolant system.

The change in lift setpoints resulted from corrosion bonding of the SRV pilot discs-to-the pilot seats. Corrosion bonding between the pilot disc and seat is an inherent problem with the two-stage SRV design used at this plant. This known phenomenon is mitigated by coating each pilot disc surface with platinum. The integrity of the platinum coating is critical. In this case, the coating was degraded in large areas of the pilot disc, including the seating surface, which was determined to be caused by circumferential machining marks in the substrate surface that led to increased circumferential cracking of the platinum coating.

The root cause was attributed to the procedures in place when these valves were refurbished and installed in the 2018 refuelling outage lacking sufficient detail to ensure consistent surface preparation and proper quality checks of surface condition prior to platinum coating. The procedures were known to be deficient, as a similar event had already occurred at the 2018 refuelling. Although the plant added the necessary guidance to ensure consistent surface preparation and proper quality checks of surface condition prior to platinum coating, the changes did not come in time to prevent reoccurrence during the next cycle.

Editor's comment – *This event may be of interest for operators running plants with safety relief valves of a similar design, subject to corrosion bonding.*

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