



## 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 April - June 2019.

# 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 it. 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 world-wide websites. When NPP related event reports are identified as potential candidates for the shortlist the information is translated into English 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

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

1. 17/01/2019: Dissimilar metal welds in two reactor coolant pumps degraded safety barriers (US / WATERFORD 3)
2. 02/03/2019: Manual reactor trip due to feedwater isolation valve closure (US / COMANCHE PEAK 2).
3. 06/04/2019: Leakage from the pressure barrier (Spain / VANDELLÓS 2).
4. 06/05/2019: Emergency diesel generators - earthquake resistance risk (France / MULTISITE).

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.

#### 3.1 Dissimilar metal welds in two reactor coolant pumps degraded safety barriers

WATERFORD 3 – 17/01/2019

While performing scheduled inspections during a refueling outage, relevant indications were detected on the Reactor Coolant Pump suction drain nozzle to safe-end butt welds during the performance of phased array ultrasonic examination of Alloy 600 dissimilar metal piping welds. The welds contribute to maintaining the RCS pressure boundary. The RCP suction drain nozzles are categorized as ASME Code Class 1 components. The indications are axially oriented and located within the butt weld and weld butter. The axial indications are inside surface connected and are exposed to the reactor coolant.

A first indication is in the axial direction and measures 0.59" which is 55% through-wall. The width of the indication is 0.40". The total thickness of the weld is 1.08". The remaining ligament 0.49" is between the flaw and the outer diameter surface.

A second indication is in the axial direction and measures 0.58" which is 50% through-wall. The width of the indication is 0.60". The total thickness of the weld is 1.17". The remaining ligament 0.59" is between the flaw and the outer diameter surface.

The actual consequence of this event was that the indications were not acceptable under ASME Section XI.

The potential consequence if the indication was through-wall is a loss of the RCS pressure boundary. This would have resulted in a small, non-isolable reactor coolant leak that would have been detected by local radiation detectors and through RCS leakrate surveillance by plant personnel.

The most likely cause of the indications is Primary Water Stress Corrosion Cracking (PWSCC).

Other than repairs and extent of condition reviews, the corrective actions included the revision of the Alloy 600 Aging Management program contingency or mitigation plans for any identified deficiencies.

**Editor's comment** – *This event has been highlighted because of the potential significance of its lessons to be learned.*

*This event may be of interest for any plant using Alloy 600 material on Reactor Coolant System components, particularly in relation to their ageing management programs.*

### 3.2 Manual reactor trip due to feedwater isolation valve closure

COMANCHE PEAK 2 – 02/03/2019

A Reactor Operator (Utility, Licensed) was performing a weekly activity to check for buzzing relays and blown fuses in the Unit 2 Main Control Room back panels. During this activity, the Reactor Operator heard a buzzing relay and attempted to narrow down which relay was buzzing by lightly touching the relays to see if the buzzing would stop. When he touched the armature of the feedwater circuit relay, the force was enough to actuate it causing a feedwater isolation valve to close. At 0317, Unit 2 was manually tripped due to this unexpected valve closure and loss of Steam Generator level control. All systems functioned as designed and the Auxiliary Feedwater Pumps started as designed due to low level in Steam Generator. There was no impact on Unit 1.

The cause of this event was the inadvertent bumping (touching) of a relay resulting in a close signal being sent to the feedwater isolation valve. The guidance provided for performing the weekly check for "buzzing" relays did not give direction to touch any components in the panel, and this was a human performance error by the Reactor Operator.

The Reactor Operator involved in this event was coached, and a site stand down was conducted on the event. Activities involving relay checks were temporarily suspended, and the weekly check for "buzzing" relays was removed from the Shift Manager Daily Activities Log. An evaluation of Operations, Control Room, and Field activities that potentially could challenge nuclear risk will be performed and all plant personnel are evaluating departmental activities to determine if similar risk challenges exist that require further evaluation.

**Editor's comment** – *This event has been highlighted because of the potential significance of its lessons to be learned.*

*This event can be seen as an example of weak / inadequate work practice, and therefore possibly of interest to any nuclear plant operator from the point of view of human factors.*

### 3.3 Leakage from the pressure barrier

VANDELLÓS 2 – 06/04/2019

During a visual inspection after an unscheduled shutdown, plant staff identified traces of boron in the plugs of the drain valves from the steam generators B and C as well as on the floor below the Steam Generator B.

During the inspection, a slight trickle was noticed from a weld downstream of the steam generator B drain valve, which represents a leakage from the reactor coolant pressure barrier. In response to this finding, plant staff took the plant from hot standby (mode 3) to cold shutdown (mode 5).

In December 2018 the licensee had identified a leak in the weld upstream of the drain valve of the steam generator B.

The plant is carrying out the analysis of the causes and the implementation of corrective measures. The Spanish nuclear safety authority has carried out a reactive inspection on the site, and has rated the event as INES 1 due to the recurrence of an event with the same cause.

**Editor's comment** – *This event has been highlighted because of the potential significance of its lessons to be learned.*

*The same plant has had issues with primary water leaks through the steam generator drain lines already two times in 2018 (first in March, see our newsletter from April-June 2018, and later in December 2018), possibly due to the same or similar causes.*



*It is essential to conduct thorough and accurate root cause analyses for this type of events, in order to identify as soon as possible the true cause of the event allowing to define the right corrective actions.*

### **3.4 Emergency diesel generators - earthquake resistance risk**

MULTISITE - 06/05/2019

An event concerning a deficiency in the earthquake resistance of the piping of the emergency diesel generator sets in the Civaux, Gravelines and Paluel NPPs was reported by EdF to the French safety authority (ASN).

Each reactor has two emergency diesel generator sets, which provide redundant electrical power supply to certain safety systems in the event of loss of off-site electrical power, more particularly in the wake of an earthquake.

The event concerns a risk of damage to the piping owing to their potential contact with certain civil engineering structures of the emergency diesel generator sets in case of earthquake. This damage could lead to rupture of these pipes and failure of the emergency diesel generating sets.

EdF initially detected this deviation at the end of October 2018 on one of the two emergency diesel generating sets for reactors 2 and 3 of the Tricastin NPP. On 6 May 2019, EdF informed ASN that, following characterisation, it also concerned the two emergency diesel generating sets for the reactors of the Civaux, Gravelines and Paluel NPPs as well as one of the two emergency diesel generating sets in other plants.

Repairs were made to the reactors concerned, except for one emergency diesel generating set for reactor 4 of the Paluel NPP, which is currently shut down. This anomaly will be corrected before the reactor is restarted.

More particularly during the course of its inspections, ASN checks that these repairs are carried out satisfactorily.

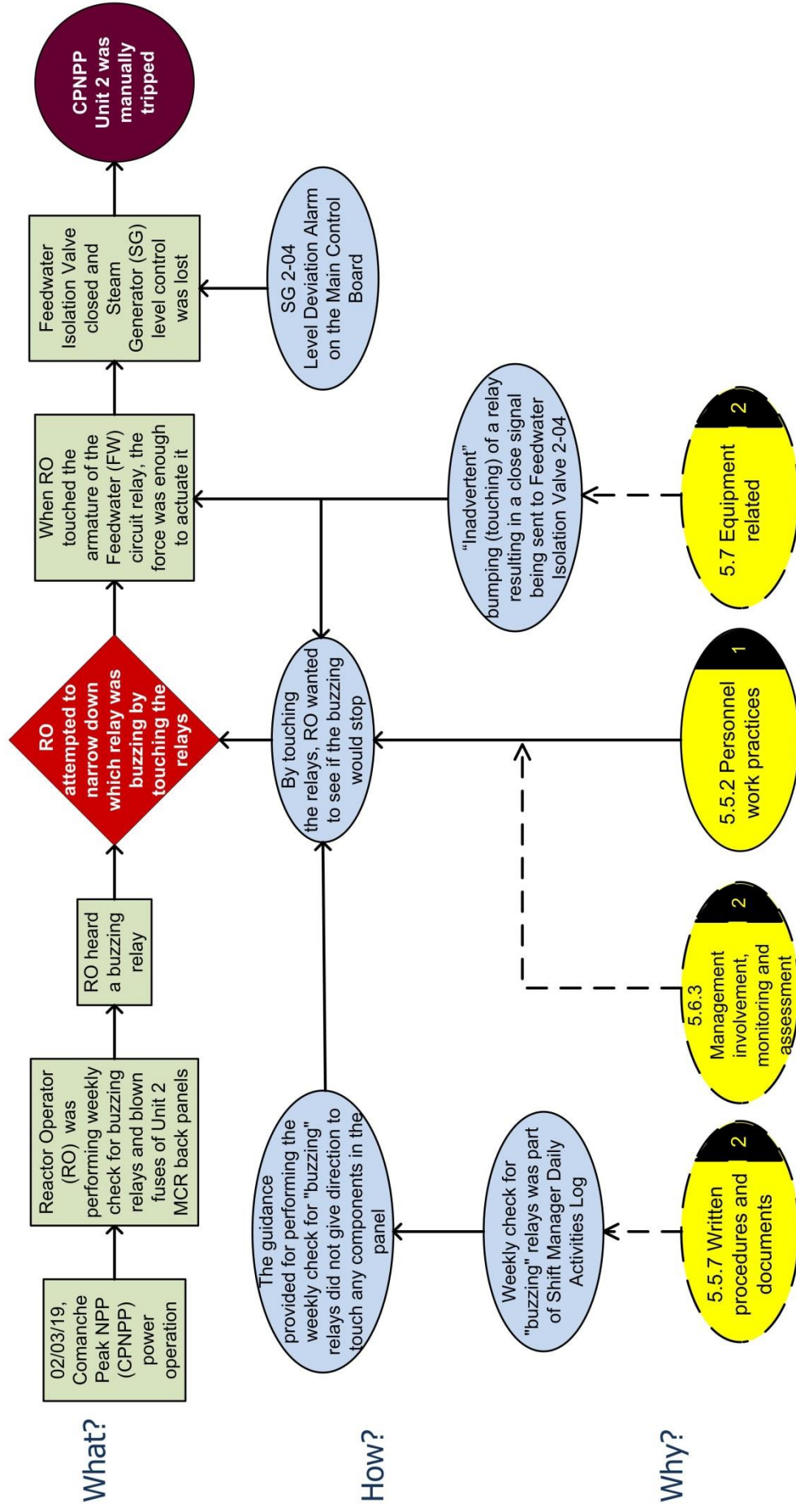
During the verifications conducted by EdF as a result of this event, a similar risk was identified at Saint-Laurent-des-Eaux NPP, where electrical cabling related to the two diesel generator sets could be damaged by civil engineering structures in case of earthquake.

In view of the potential safety consequences, ASN has rated the event as INES 2 for Gravelines, Paluel, Civaux and Saint-Laurent-des-Eaux stations and INES 1 for some additional reactors (where only one of the two DG sets was concerned).

***Editor's comment*** – *This event has been highlighted because of its rating as INES 2.*

*The seismic resistance of the emergency power generation systems is of utmost importance, notably because frequently a weakness in the design or in the manufacturing / installation affects both redundant trains at the same time.*

# Manual Reactor Trip Due To Feedwater Isolation Valve Closure



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