

JRC TECHNICAL REPORTS

Quarterly report on NPP events

April – June 2018

Peinador Veira M.

2018



This publication is a Technical report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication.

Contact information

Name: Miguel PEINADOR VEIRA

Address: Westerduinweg 3, PO Box, 1755 ZG Petten – The Netherlands

Email: Miguel.PEINADOR-VEIRA@ec.europa.eu

Tel.: +31 (0)224 56 5176

JRC Science Hub

<https://ec.europa.eu/jrc>

JRC112712

© European Atomic Energy Community, 2018

Reuse is authorised provided the source is acknowledged. The reuse policy of European Commission documents is regulated by Decision 2011/833/EU (OJ L 330, 14.12.2011, p. 39).

For any use or reproduction of photos or other material that is not under the EU copyright, permission must be sought directly from the copyright holders.

How to cite this report: Peinador Veira M, Quarterly Report on NPP events: April-June 2018, JRC112712

All images © European Atomic Energy Community 2018, except title page photo, courtesy of www.pixabay.com

Contents

Foreword	2
Abstract.....	3
1 Introduction	4
2 Events short-listed	5
3 Events selected.....	6
3.1 Leakage in the Reactor Cooling System loop A area.....	6
3.2 Partial Reactor Protection System inoperability during functional tests.....	8
3.3 Findings at the cooling water temperature controller of the emergency diesel generator	8

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 2018.

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, accesible 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

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

1. 02/03/2018: Leakage in the Reactor Cooling System loop A area (SPAIN / VANDELLOS 2).
2. 06/03/2018: Inoperable reactor protection functions during Main Steam Isolation Valve and Turbine Stop Valve channel functional tests due to use of a test box (US / GRAND GULF 1).
3. 05/04/2018: Findings at the cooling water temperature controller of the emergency diesel generator (GERMANY / GROHNDE).

The information provided is extracted from publicly available or 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 Leakage in the Reactor Coolant System loop A area

VANDELLOS 2 – 02/03/2018

During normal power operation on 05/02/18, the staff noted an increase in water flow to the sump receiving drains from the Reactor Coolant System (RCS) loop A area.

Based on sampling of the sump, the staff estimated a leak for the RCS in the range of 5/6 l/hr, and several days later a range of 8/10 l/hr was estimated based on containment atmosphere monitoring and other means. The licensee followed its internal procedure for the case of RCS leaks, including several entries to containment to try to locate the leak, in some cases aided by robots, and concluded on 2 March that one vent valve in the safety injection system accumulator discharge line to the cold leg was leaking steam. However the inspections did not allow knowing if the leak was an RCS pressure boundary leak, and the licensee decided then to shutdown the plant for a closer inspection.

On the same day, with the reactor in Mode 3, it was confirmed that the leak originated at the vent valve socket weld, and was therefore a pressure boundary leak.

Additional inspections revealed also boric acid deposits in one of the steam generator drain valves, caused by a very small leak through the weld between the drain line and the steam generator bottom head.

According to the evidence obtained from the inspections carried out, preliminary analyses and external operating experience, the licensee considered that the most probable cause for each of the leaks is the following:

- In the socket welding in the accumulator vent valve: Fatigue due to high cycles possibly combined with welding defect during construction.
- In the steam generator drain: This weld is made from Inconel material 82/182, which is known to be susceptible to primary water stress corrosion cracks (PWSCC) mechanisms.

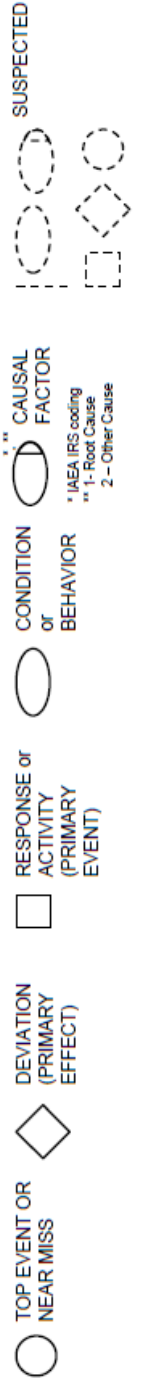
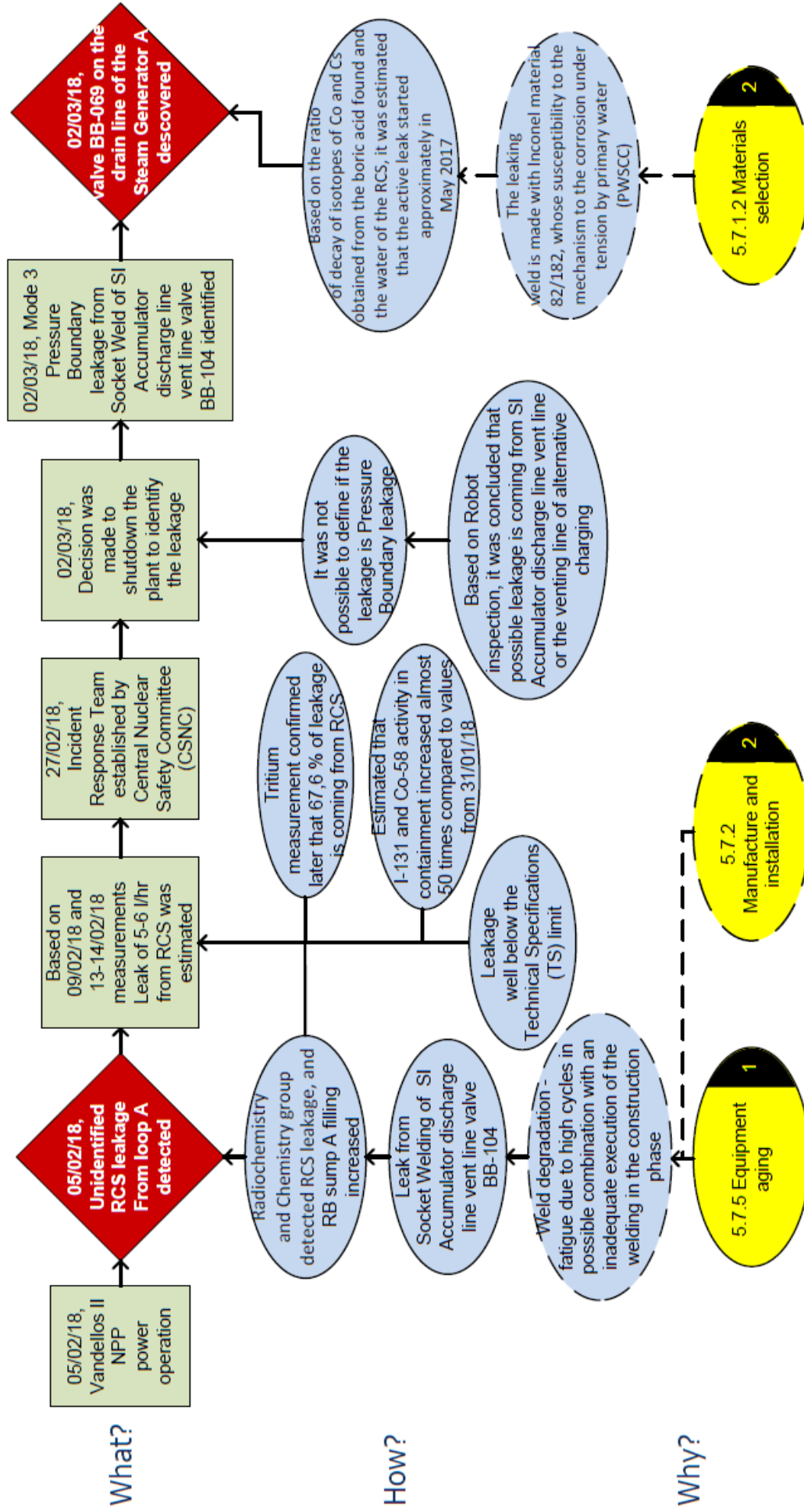
Corrective actions include the change in the design of the accumulator vent valve to make it more robust, and the replacement of the inconel 82/182 material by Inconel 690 for all the steam generators. Furthermore, the licensee will carry out visual inspections and penetrant liquid inspections on a population of around 75 socket welds of different diameters.

The event has been rated as INES 0.

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

During the quarter covered by this newsletter, two other RCPB leaks have been reported:

Pressure Boundary leakage from the Socket Weld of SI Accumulator discharge line vent line valve



- *Doel 1 reported a leak in the upper plenum injection line of the safety injection system (on the base material), located in a piping section between the Reactor Pressure Vessel wall and the concrete wall surrounding the reactor. High radiation levels in the area will be an issue during the repairs.*
- *La Salle 1 reported another leak at a reactor recirculation pump discharge valve (leak through a socket weld in a ¾" vent line off the valve bonnet caused by fatigue cracking that initiated on the external surface of the pipe).*

These events suggest that leaks through the RCPB is a frequent cause of unscheduled reactor shutdowns, and the following comments can be made:

- *Fatigue phenomena in small diameter socket welds (usually vents, drains) are often the root cause;*
- *Accurate and rigorous use of all monitoring methods to detect leaks inside containment is essential. Furthermore, these leakage events give the opportunity to licensees to evaluate the practical efficiency of the monitoring tools by comparing the preliminary leak readings against the confirmed leak values obtained after full inspections and assessments are completed;*
- *In PWRs, clear procedural guidance on when the entry to the containment for further inspection is justified can be helpful;*
- *Robot-based inspections to identify leaks within the containment can be helpful.*

3.2 Partial Reactor Protection System inoperability during functional tests

GRAND GULF 1 – 06/03/2018

On March 6, 2018, during a review of industry operating experience, it was determined that use of the Reactor Protection System (RPS) test box described in station procedures would potentially result in the loss of two RPS reactor scram safety functions (Function 6 for Main Steam Isolation Valve - Closure and Function 9 for Turbine Stop Valves Closure).

It was concluded that an isolation of three of four Main Steam Lines or Turbine Stop Valves would not necessarily have resulted in a full scram during testing, as required by the technical specifications of the plant, depending on the combination of closed valves occurring while the test box was in use.

Modifications to RPS test procedures were approved in 2014 to accommodate the use of the test box. Between May 2016 and February 2018, the MSIV Closure and TSV Closure procedures were each performed 6 times using the test box. While it did not meet the technical specification bases, the RPS remained functional at all times. The failure to recognize the impact of the modification and procedure revisions is considered a human performance error by engineering personnel.

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

Two additional very similar events have been reported in the same period covered by this newsletter by other plants (Duane Arnold 1 and Monticello), suggesting that plants having introduced in recent years modifications in their RPS test procedures linked to the use of test boxes to simulate the signals may be interested by this operating experience.

3.3 Findings at the cooling water temperature controller of the emergency diesel generator

GROHNDE – 05/04/2018

With the reactor under normal operation, during the periodic test “overloading rate” of one of the four emergency diesel generators, the diesel tripped on high temperature cooling water protection. After inspection, surface deposits on the water temperature controller were discovered.

The deposits were of the same type than those found at the same location a few years ago (event reported in October 2015). In the previous event, the deposits had been attributed to the use of a particular anti-freezing product, however, after this new incident, the origin of the deposits is not known.

The affected component has been replaced and the cause of the failure is under investigation by the manufacturer of the emergency diesel engine. According to the operator, the safety function of the emergency diesel generator was not affected yet by the surface deposits (the diesel tripped on a protection signal active during the test) and back-up diesel engines were available.

The event has been rated as INES 0.

Editor’s comment – *This event has been highlighted because of the significance of its lessons learned.*

This event and the subsequent investigation may be of interest to any licensee operating similar diesel generators for the improvement of their maintenance and inspection plans and procedures.

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: <http://europea.eu/contact>

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696, or
- by electronic mail via: <http://europa.eu/contact>

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: <http://europa.eu>

EU publications

You can download or order free and priced EU publications from EU Bookshop at: <http://bookshop.europa.eu>. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see <http://europa.eu/contact>).

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



EU Science Hub
ec.europa.eu/jrc



@EU_ScienceHub



EU Science Hub - Joint Research Centre



Joint Research Centre



EU Science Hub

