

JRC TECHNICAL REPORTS

Quarterly report on NPP events

July – September 2020

A. Ballesteros
M. Ioakeimidou
G. Manna
M. Peinador
P. Pla
Z. Simic
J. Tanarro

2020



Contents

Foreword2

Abstract3

1 Introduction4

2 Events short-listed.....5

3 Events selected6

 3.1 Plant shutdown due to inoperable containment purge isolation valves6

 3.2 Fire dampers and flame arresters thermal fuses wrong rating6

 3.3 Extended unavailability of the site combustion turbine.....7

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 July - September 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. 01/02/2020: Plant shutdown due to inoperable containment purge isolation valves (US / WOLF CREEK).
2. 22/05/2020: Fire dampers and flame arresters thermal fuses wrong rating (FRANCE / CHOOZ B1/2).
3. 15/07/2020: Extended unavailability of the site combustion turbine (FRANCE / ST ALBAN 1/2).

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 Plant shutdown due to inoperable containment purge isolation valves

WOLF CREEK – 01/02/2020

The containment shutdown purge system operates during reactor outages (Mode 6 and Defueled) to supply outside air into the containment for ventilation and cooling or heating and may also be used, when the reactor is in the cold shutdown mode (Mode 5), to reduce the concentration of noble gases within the containment prior to and during personnel access. The supply line has automatic containment isolation valves both inside and outside containment, and they are required to be maintained sealed closed during modes 1, 2, 3 and 4.

Prior to the event on Feb 1, the plant was operating at 100% power. The outside isolation valve had been inoperable since November 2, 2019, due to excessive leakage, and had a blind flange installed. The inside valve was closed and de-energized, as required by the technical specifications.

A surveillance testing conducted on Feb 1 revealed that the leakage rate through the penetration was too high, containment was declared inoperable and the plant had to be shutdown. After repairs, both valves were returned to service the following day, and the plant subsequently returned to Mode 1 on Feb 3.

The proximate cause of the event was that the elastomer T-rings on the valves experienced relaxation due to viscoelastic creep. The T-ring is an elastomer on the valve disc that seals against the seat of the valve body by forcing the material to extrude. The root cause was that the staff did not fully institutionalize the information regarding the relaxation of the T-ring on the 36-inch valves following initial installation.

As an additional corrective action, core work instructions were revised to include information about T-ring replacement and adjustments.

Editor's comment – *This event has been selected because of the interest of its lessons learned. It highlights the need to adequately capture the knowledge of plant staff into applicable plant documents and procedures, and particularly in ageing programs.*

3.2 Fire dampers and flame arresters' thermal fuses wrong rating

CHOOZ B1/2 – 22/05/2020

Fire dampers and flame arresters help to contain the effects of a fire in a given group of rooms by preventing the spread of fumes through the ventilation circuits to adjacent rooms. They thus make it possible, during a fire, to protect equipment and prevent

failures. When a given temperature is reached, a thermal fuse installed in each valve melts and allows the valve to close.

The faults detected by EDF on a number of these thermal fuses were of two types:

1. The valve was fitted with a fuse of a higher rating than required, which causes it to close late if the temperature rises. This case involved 32 fire dampers distributed over all the reactors affected by these defects. EDF's analysis concluded that the late closing of these valves in the event of a fire was not likely to cause the fire to spread and had no consequences for the safety of the installations.
2. The valve was fitted with a fuse of a lower rating than required, causing it to close early if the temperature rises. This case concerned 16 flame arresters distributed over reactors 1 and 2 of the Chooz B NPP. These valves protect the iodine filters, which have the function of filtering radioactive releases in the event of an accident. Early closure of these valves in an accident situation would have made these filters unavailable and would have led to radiological consequences greater than those envisaged for these situations.

This event was rated by the French regulator as INES 1 for reactors 1 and 2 of the Chooz B nuclear power plant and as INES 0 for other reactors. EDF replaced the affected fuses and launched a control campaign to verify the correct calibration of the fuses on its other reactors.

Editor's comment – *The event has been highlighted due to its potential for common cause failures*

3.3 Extended unavailability of the site combustion turbine

ST ALBAN 1/2 – 15/07/2020

Each reactor is equipped with two redundant emergency diesel generators providing power to certain safety systems in the event of failure of offsite power. A combustion turbine (TAC) can be connected to the reactor electrical supply panels, replacing one of the emergency diesels in reactor 1 or 2. In addition, and following the accident at the Fukushima Daiichi nuclear power plant, a third emergency diesel generator, more resistant to external hazards, was installed on each reactor: this is the last resort diesel (Diesel ultime secours, DUS).

As part of the DUS installation work, the plant modified in July 2019 the electrical panels of the two reactors, and in particular the TAC inlet electrical cells on these panels. A specificity of the site's electrical cells was not taken into account in the design and the modification actually disabled the connection to the TAC. The validation tests after the modification were completed, but they were not able to detect the failure. The unavailability of the TAC was only revealed on June 26, 2020, during the complete operational tests of the DUS, which require to connect these electric cells.

As the TAC was never called upon, this unavailability did not have a direct consequence on the facilities, on the personnel or on the environment. However, due to the design flaw of a modification that led to the prolonged unavailability of the TAC, this event was classified as level 1 on the INES scale.

Editor's comment – *This event has been highlighted due to the interest of its lessons learned. In the aftermath of the Fukushima accident, numerous safety upgrades have been implemented in NPPs around the world, particularly regarding the robustness of the emergency power systems. However, safety upgrades are plant modifications, and as such they carry a potential threat to plant safety. This event recalls that design modifications must be subject to strict change management controls, and that the corresponding validation tests must be comprehensive, covering all applicable failure modes.*

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://europa.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