



Authority for Nuclear Safety and
Radiation Protection

Report on events in Dutch nuclear facilities during 2016

Publisher's details

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Executive summary

Number of events

In 2016, the Dutch nuclear facilities reported 14 events. The number of events is, therefore, in line with previous years. Three events occurred at the Borssele Nuclear Power Plant (KCB) and eleven occurred at other nuclear facilities. Of the latter, one occurred at the Nuclear Research and Consultancy Group's (NRG) High Flux Reactor (HFR), nine at NRG's other facilities, and one at the Dodewaard nuclear power plant (which was already closed).

INES rating and severity

Nuclear safety was not compromised during any of the events which occurred in 2016. The events reported in 2016 were, as in 2015, less serious¹ than the annual average of the last five years. None of the events was rated as an INES incident, thus all of these events fall within the unofficial 'category' INES level 0.² As yet, a number of events still only have a provisional rating, pending the final completion of the investigations.

Borssele Nuclear Power Plant

Few events were reported at the Borssele nuclear power plant in 2016, as was the case in previous years. ANVS has established that the licensee of the nuclear power plant (Electricity Production Company South-Netherlands; EPZ) is systematically focusing on reducing the number of events. The procedures followed when dealing with events require attention. There is a need for more complex analysis and reporting. EPZ generally reports its events in good time. It also pays all due attention to the procedures followed in such cases. ANVS actively supervises the measures proposed by EPZ in response to an event. ANVS has occasionally issued instructions in this connection.

NRG

This year, only a single event occurred at the HFR in Petten. The number of events at the other NRG facilities was the same as in previous years (nine). The decrease in severity of the reported events which have occurred since 2014 is in line with the improvement programme being implemented by NRG since 2013. At the other NRG facilities, ANVS has indicated that it expects improvements to be made, in the near future, in the speed and diligence with which events are dealt with. The same applies to the ensuing investigations. Both of these aspects will be subject to intense supervision. In presenting this report to NRG, ANVS has instructed the NRG to draw up an action plan to improve the way in which events are dealt with, especially at its other facilities.

Joint Nuclear Power Plant Nederland (GKN), Dodewaard

By 2016, a single event was reported by GKN, the licensee for the Dodewaard nuclear power plant, which is 'in safe enclosure'.

Other nuclear facilities

No events occurred at other Dutch nuclear facilities in 2016.

General conclusion

Table 1 summarises all the events which occurred in 2016. Based on the information available, ANVS concludes that the policy of reducing the number of events at the HFR and EPZ appears to be bearing fruit. As yet, ANVS has seen no noticeable decrease in the number of events at the remaining NRG facilities. ANVS is positive about licensees' greater willingness to report events. However, ANVS notes that guidance is still needed with regard to the way in which events are dealt with. With particular regard to the production of final reports about events, greater speed and diligence are required.

¹ The final rating of the severity of a number of events has not yet been determined because further investigations are still ongoing. The final ratings of these events are not expected to differ fundamentally from their provisional ratings.

² For more information on the INES scale, see <https://www.autoriteitnvs.nl/onderwerpen/ines>.

Role of the regulator ANVS

ANVS is involved in the improvement of the safety of Dutch nuclear facilities. It monitors the progress and effectiveness of the measures taken, carries out on-site inspections and, where necessary, applies enforcement instruments to improve compliance with KEW licences.

Table 1: The total number of events subject to a reporting requirement in 2016 at each company, categorised according to INES level (provisional).

Facility	Total number of events subject to a reporting requirement	INES level 0	INES level 1	INES level 2
Borssele nuclear power plant	3	3 ³	-	-
High-Flux Reactor, Petten	1	1	-	-
Other NRG facilities, Petten	9	9 ⁴	-	-
Central Organisation for Radioactive Waste, Nieuwdorp	-	-	-	-
Higher Education Reactor, Delft	-	-	-	-
Energy research Centre of the Netherlands (ECN), Petten	-	-	-	-
Joint Research Centre, Petten	-	-	-	-
Joint Nuclear Power Plant Nederland, Dodewaard	1	1	-	-ww
URENCO Nederland, Almelo	-	-	-	-
Total nuclear facilities	14	14	-	-

³ As of 1 March 2017, two ratings are provisional.

⁴ As of 1 March 2017, eight ratings are provisional.

Introduction

This report summarises the events which occurred at Dutch nuclear facilities in 2016. On 27 February 1980, the then Minister of Social Affairs undertook to inform the House of Representatives about the functioning of Dutch nuclear power plants, in writing, annually. In the course of time, this report has expanded to include all nuclear facilities in the Netherlands and the radiological laboratories associated with these facilities.

This report documents events which are related to a disruption in the normal operation of the facility. These events may concern technical defects at the facility or human error. In exceptionally serious cases, they may have to do with situations in which radioactive materials were, or could have been, discharged, an abnormal increase in a normal discharge of radioactive materials, an increase in the radiation level at the site boundary or the unintended emission of radioactive materials outside the facility. This summary also includes any contamination of employees in the nuclear facilities, which is subject to a notification requirement under the licence or the Radiation Protection Decree.

Under the Nuclear Energy Act (KEW) licence, events must be reported to ANVS. The notification requirements may vary, depending on the nature of the event in question. Notification criteria are laid down in individual KEW licences for each nuclear facility. These criteria determine which events have to be reported to ANVS and the subsequent time frame. The notification period depends on the nature of the events in question. It can vary from 'immediately' to 'within 4 weeks'. Additionally, there are some events that do not require an active notification. These include, for example, slight contamination of surfaces or equipment and technical defects and organisational deviations without immediate consequences for the operation of the facility or nuclear safety. These must be described in quarterly, six-monthly, or annual reports, for example. The latter notifications are beyond the scope of this report. Every year, ANVS carries out an inspection of these events, during which it determines whether they were dealt with properly.

Events have two important aspects. Firstly, the event itself, the nature and severity of which must be determined, and the consequences, which must be controlled. It is, moreover, important that, after an event has occurred, it is systematically analysed and that the necessary action is taken to prevent any recurrence. Events vary in their degree of severity, from relatively insignificant incidents to major accidents. 'Minor' events may be symptomatic of an underlying problem and the simultaneous occurrence of several minor events may have larger consequences. This is why events have to be recorded and reported accurately and immediately. Following the initial notification, licensees are required to conduct an investigation into the exact nature and circumstances of the event in question. As part of the wider investigation, there should be a focus on the lessons to be learned and on potential improvement measures, to prevent any recurrence. This is the task of the licensees of nuclear facilities and it contributes greatly to the continuous improvement of safety at nuclear facilities. ANVS ensures that this takes place and performs its regulatory role from the moment a notification is made until the associated procedure has been completed. It then ensures that the learning and improvement points are properly followed up at the facilities in question.

The events reported are classified according to INES. INES stands for 'International Nuclear and Radiological Event Scale'. The INES scale is to nuclear events as the Richter scale is to earthquakes: it is an indication of severity. Further details about the INES scale can be found in the appendix to this report.

ANVS actively informs the general public about nuclear safety and radiation protection. This is why information about events which take place at nuclear companies is communicated at ANVS's website as soon as it becomes available⁵. This site presents the current state of affairs. The descriptions of events in this report reflect the state of affairs as per 1 March 2017.

⁵ See <http://www.autoriteitnvs.nl/onderwerpen/ongewone-gebeurtenissen>.

To produce a good INES rating, sufficient information is required. In addition to the severity of the event itself, the INES rating also examines its underlying causes. In exceptional cases, the underlying causes can lead to an INES rating being increased by one level. This can only be determined once the investigation into the underlying cause has been completed.

In this report, the INES rating for various events is still 'provisional', as the investigations of some reported events still have to be completed. ANVS also conducts a specific annual inspection of all internally recorded events at the companies, to ensure that all events that are subject to a reporting requirement were indeed reported. ANVS does not expect either the definitive way in which notifications are dealt with or the results of these inspections to lead to fundamentally different conclusions regarding the nature and number of events. Nevertheless, if this should prove to be the case, details will be published at the website and in the 2017 report on events. Accordingly, the 2017 report will include an unequivocal statement about the completeness of the notifications listed in the 2016 report.

This report includes the notifications made under the KEW by the following licensees⁶:

- the Electricity Production Company South-Netherlands (EPZ) in Borsele with the Borssele Nuclear Power Plant (KCB);
- the Nuclear Research and Consultancy Group (NRG) in Petten, with two licences for the following facilities:
 - the High Flux Reactor (HFR);
 - the Low Flux Reactor⁷ (LFR), the Hot Cell Laboratories (HCL) comprising the Research Laboratory (RL) and the Molybdenum Production Facility (MPF), the Decontamination and Waste Treatment Facility (DWT) and the Waste Storage Facility (WSF);
- the Central Organisation for Radioactive Waste (COVRA) in Nieuwdorp;
- Delft University of Technology with the Reactor Institute Delft (RID) with the Higher Education Reactor (HOR), the sub-critical ensemble DELPHI and laboratories;
- the Energy research Centre of the Netherlands (ECN) in Petten;
- the Joint Research Centre of the European Commission (GCO) in Petten;
- the Joint Nuclear Power Plant Nederland (GKN) in Dodewaard, which was definitively shut down in March 1997 and is 'in safe enclosure' and
- URENCO Nederland's enrichment plants in Almelo.

⁶ The licensees named can be divided into two categories: licensees under Nuclear Energy Act Section 15(b) (EPZ, COVRA [Central Organisation for Radioactive Waste], RID [Reactor Institute Delft], NRG-HFR, NRG-other, GKN and URENCO) and licensees under KEW Section 15(a), Section 29 and Section 34 (ECN and GCO).

⁷ Operations at the Low Flux Reactor were stopped at the end of 2010. The licence for the decommissioning of the reactor was issued on 18 December 2014. Decommissioning started in 2015.

1 Events in the Netherlands in 2016

This chapter summarises the events, which were reported to ANVS, that occurred at Dutch nuclear facilities in 2016.

1.1 Borssele Nuclear Power Plant (KCB), Borsele

In 2016, EPZ (the licensee of the Borssele nuclear power plant) reported three events to ANVS.

8 June 2016: Failure of one of the fuel storage basin cooling system's pumps; INES level 0 (provisional rating)

On 8 June 2016, EPZ reported that, on 5 June 2016, ongoing work resulted in a short-circuit that caused a number of components to fail. One of the affected components was a pump in the fuel storage basin's cooling system. This cooling system ensures that the temperature in the fuel pool (which is used to store new and spent fissionable material) does not get too high. At that time, two of the cooling system's pumps were in operation. That was also the minimum number required, according to the nuclear power plant's Technical Specifications.

EPZ had the pump operational again within the set time limit. The pump failure resulted in a slight temperature rise in the fuel storage basin. The company is conducting an investigation to determine what lessons can be learned from this event. ANVS is supervising the investigation and will assess the result and the proposed measures.

Based on the information available so far, ANVS has provisionally rated this event at INES level 0: a minor deviation, as the situation was rectified within the set time limit. The event will be assigned a final rating after assessment of the results of the further investigation.

15 July 2016: Borssele nuclear power plant temporarily shut down following event during test; INES level 0

On July 15, 2016, EPZ reported that, on the same day, the Borssele nuclear power plant was automatically shut down for a short period of time during a planned test. Nuclear power plants routinely test components to see whether they are functioning properly, both during maintenance shutdowns and while the plant is in operation. While tests were being carried out on a number of valves that regulate the supply of steam to the turbine, the reactor's automatic safety systems were triggered, leading to the shutdown of the reactor. Switched wiring in two valves was found to be the cause of this shutdown. The switched wiring was rectified immediately. After checking the wiring in the other valves, the reactor was started up again, according to the specified procedure. EPZ is conducting an investigation to identify the underlying cause of this event, in order to take improvement measures, if applicable.

In accordance with procedure, ANVS was informed of the event in good time. It is supervising the investigation and will assess the result and the proposed measures. Based on the information available so far, ANVS has provisionally rated this event at INES level 0: no safety significance, because the reactor's monitoring system responded in accordance with the requirements. It will not be possible to assign a final rating until the results of EPZ's investigation are known.

Update after final report

EPZ has investigated the underlying cause that led to switched wiring in two valves, and has taken measures to prevent any recurrence in the future. This includes marking the ??? to reduce the likelihood of a wiring switch. In addition, the procedure has been improved, to check that the valves are functioning properly before the turbine comes into operation. ANVS has assessed the results of the investigation and the proposed measures. It will supervise the implementation of these measures. Based on the information provided by EPZ, ANVS has definitively rated this event at INES level 0: no safety significance.

11 October 2016: Automatic reactor shutdown after pump failure; INES level 0 (provisional rating)

On 11 October 2016, EPZ reported that the reactor had shut down automatically that day. The shutdown was caused by the failure of one of the steam generators' feedwater pumps due to an operating error. EPZ reported the reactor shutdown in a timely and correct manner. The company is conducting an investigation to determine how this error could have occurred. In the meantime, the reactor has been restarted.

ANVS is supervising the investigation and will assess the result and the proposed measures.

Based on the information available so far, ANVS has provisionally rated this event at INES level 0: a minor deviation.

The event will be assigned a final rating after assessment of the results of the further investigation.

1.2 Other Dutch nuclear facilities

1.2.1 NRG High-Flux Reactor (HFR), Petten

In 2016, NRG (the licensee of the HFR) reported one event to ANVS.

12 September 2016: Preventive shutdown due to slightly abnormal test signal; INES level 0

On 12 September 2016, the Nuclear Research and Consultancy Group (NRG) reported that the High Flux Reactor (HFR) had been shut down as a precautionary measure. The reason for this was that NRG had detected an increase in 'noise' in the instruments that monitor reactivity in the reactor. The measurements fluctuated more than is usual during normal operations. No limits for safe reactor operation were exceeded as a result of this event.

The continual monitoring of reactivity in the reactor is one of the measures taken to guarantee safety.

NRG is currently investigating the cause of the deviation. ANVS is keeping track of developments and of the investigation.

Based on the information available, ANVS has provisionally rated this event at INES level 0: no safety significance, because the facility operated within the safety limits.

Update after final report

NRG has completed the investigation into the cause of the deviation, and has taken measures. The investigation confirmed that no limits for safe reactor operation were exceeded as a result of this event. NRG has presented the results of the investigation to ANVS, together with details of the measures taken. NRG is sufficiently certain that operations can be resumed in a safe and responsible way. ANVS endorses this position and has issued a declaration of no objection to the restart of the HFR. This took place on 24 September.

Based on NRG's investigation, ANVS has definitively rated this event at INES level 0: no safety significance, as the event involved a process deviation that remained well within the safety limits.

1.2.2 Other NRG facilities⁸, Petten

In 2016, NRG reported nine events to ANVS, which occurred at NRG's other facilities.

24 February 2016: Underpressure alarm triggered due to an open hot-cell pass-through port resulting in the evacuation of the Hot Cell Laboratories (HCL); INES level 0 (provisional rating)

On 24 February 2016, NRG reported that on 15 February 2016, the underpressure alarm in one of the Hot Cell Laboratories' (HCL) hot cells was triggered when a pass-through port in the hot cell's roof door was unintentionally left open. The pressure in hot cells is kept below that of the surroundings, to prevent the escape of any radioactive materials that are being processed in the hot cell. The underpressure alarm was automatically followed by an evacuation alarm, after which the HCL was temporarily evacuated. At the time the alarm was triggered, radioactive waste was being processed in the hot cell. After the evacuation, employees wearing respiratory protection equipment entered the HCL and, by means of contamination testing, determined that no dispersal of radioactive materials had occurred. NRG reported that no employees received an increased radiation dose as a result of this event.

NRG is investigating the cause of this event. An initial evaluation revealed that a check to ensure that the pass-through port was closed was hampered by the fact that fewer employees than usual were carrying out the work in question. In order to prevent a situation like this from recurring in future, NRG has tightened up the procedure for this work.

⁸ 'Other facilities for which NRG has a licence' are taken to mean the Hot Cell Laboratories (HCL), comprising the Research Laboratory (RL) and the Molybdenum Production Facility (MPF), Low Flux Reactor (LFR), Waste Storage Facility (WSF), Decontamination and Waste Treatment (DWT) and other laboratories, including the Jaap Goedkoop Laboratory (JGL).

ANVS is supervising NRG's investigation and will assess the result and the proposed measures. Based on the information available so far, ANVS has provisionally rated this event at INES level 0: no safety significance. It will not be possible for a final rating to be assigned until the results of the investigation by NRG are known.

7 March 2016: Unresponsive monitor in molybdenum production facility (MPF) resulted in failure to communicate up-to-date measurement data; INES level 0 (provisional rating)

On 7 March 2016, NRG reported that on 17 February 2016, an event occurred in one of the three monitoring systems in the molybdenum production facility (MPF). This monitoring system measures the level of airborne radioactive materials in various production areas and triggers an alarm if the measured values are too high. Production is conditional on the correct functioning of all monitoring systems. As a result of the event, the measurement data was not visible nor was it stored on the computer. Because the monitor continued to display a previously measured value, the event was not noticed during the production start-up checks. However, it was noticed during a more extensive, routine check two days later.

NRG is investigating the cause of this event. An initial evaluation revealed that the monitoring system had become unresponsive due to a hardware problem, which itself was due to wear and tear. NRG has replaced the defective system and has modified the production start-up checks to ensure that no such event will be overlooked in future.

NRG has two other monitoring systems for radioactive materials, which measure discharged air, and a back-up monitor in the production hall. During the event in question, none of these systems measured increased values, from which NRG concludes that it had no impact on people and the environment. NRG will monitor the investigation into the underlying cause of this event.

Based on the information available so far, ANVS has provisionally rated this event at INES level 0: no safety significance, as any release of radioactive materials in the production hall or in the discharged air would have been picked up by the other monitoring systems. Accordingly, no safety barrier has been breached.

ANVS is supervising the follow-up to this investigation and will assess the result and the proposed measures.

4 May 2016: Underpressure alarm triggered followed by a monitoring alarm in an iodine hall monitor in the Hot Cell Laboratories (HCL); INES level 0 (provisional rating)

On 4 May 2016, NRG reported that, on 31 January 2016, an underpressure alarm in one of the hot cells in the molybdenum production facility (MPF) was triggered, followed by an automatic evacuation alarm. For several minutes, while maintenance work was being carried out, there was an open connection between the hot cell and the control room. Some time later, the measuring system that checks for the presence of radioactive iodine triggered an alarm in another work area near the hot cells. NRG has been unable to determine what triggered this alarm. None of the other measurement systems recorded an increase in the level of radioactive materials. At the time the iodine alarm was triggered, no-one was present in the work area.

NRG is conducting an investigation to determine what it was that triggered the iodine alarm. Depending on the results of this investigation, NRG will propose measures to prevent situations of this kind arising in the future.

ANVS is supervising the investigation and will assess the result and the proposed measures. In response to queries from ANVS about why this incident was not reported within the prescribed time limit, NRG stated that, for some time, it was unclear whether the event in question was or was not subject to a notification requirement.

Based on the information available so far, ANVS has provisionally rated this event at INES level 0: no safety significance because, although there was a deviation from the normal conditions, for the time being this has not had an impact on safety. It will not be possible for a final rating to be assigned until the results of the investigation by NRG are known.

5 July 2016: Inhalation of radioactive material due to a damaged calibration source in the Jaap Goedkoop Laboratory (JGL); INES level 0 (provisional rating)

Following a telephone announcement on 1 July, NRG reported on 4 July 2016 that an employee in one of the laboratories of the Jaap Goedkoop Laboratory (JGL) had suffered internal contamination on 22 June 2016. The contamination was caused by the inhalation of a small amount of americium-241 (Am-241), an alpha-emitter with a high level of toxicity (and radiotoxicity). While radioactive calibration sources were being transferred to a new casing, one of the sources was found to be damaged. This led to the release of a small amount of this radioactive material.

As a result of the notification, ANVS inspectors initiated an investigation at NRG on 6 July. This included an investigation into the circumstances and severity of the event in question, and into the actions taken by NRG regarding the health of the affected employee. Another line of enquiry concerned the measures taken to prevent the dispersal of the radioactive material in question. This showed that the impact was limited, and agreements were made concerning the further investigation to be carried out by NRG.

NRG is investigating the size of the radiation dose suffered by the employee concerned, and how this event could have occurred. Based on the results of this investigation, NRG will take measures to prevent any recurrence in the future. In the initial investigation report, NRG concludes that the employee concerned was the only individual to be exposed to the radioactive material that was released. NRG provisionally estimates the dose at approximately 1.5 mSv, which is well below the annual dose limit of 20 mSv. NRG has arranged for an external party to carry out test measurements, to verify this estimate. NRG has determined that no radioactive materials were released outside the laboratory. ANVS is supervising the investigation and will assess the result and the proposed measures. In this context, there will be a special focus on determining the dose involved, on the welfare of the employee concerned, and on how this event was dealt with. Based on the information available so far, ANVS has provisionally rated this event at INES level 0: a minor deviation. It will not be possible for a final rating to be assigned until the results of the full investigation by NRG are known.

13 July 2016: Underpressure alarm and evacuation alarm triggered in the Hot Cell Laboratories (HCL); INES level 0

On 13 May 2016, NRG reported that, on 4 July 2016, the underpressure alarm was triggered while a transport container for radioactive materials was being connected up to one of the hot cells. The hot cells, in which radioactive materials are processed, must be kept at a lower pressure than the surrounding rooms to prevent the dispersal of radioactive materials. The underpressure alarm was automatically followed by an evacuation alarm in the research laboratory inside the Hot Cell Laboratories (HCL). Following the evacuation, NRG performed measurements but found no radioactive materials outside the hot cell. The event has not had an impact on the safety of employees or that of the population.

NRG is investigating how this incident could have taken place and will take measures to prevent any recurrence in the future. ANVS is supervising the investigation and will assess the result and the proposed measures. The assessment will also examine the increased frequency of underpressure alarms during transport movements in the HCL.

Based on the information available so far, ANVS has provisionally rated this event at INES level 0: no safety significance, because no radioactivity was released and sufficient safety barriers were still in place to prevent the dispersal of any radioactive materials outside the facility. It will not be possible for a final rating to be assigned until the results of the investigation by NRG are known.

Update after final report

After investigating this event, NRG has concluded that the loss of underpressure was caused by the incorrect connection of the transport container to the hot cell. According to NRG, the underlying cause was a change in the operating instructions, which has not had sufficient follow-up in terms of training and instruction for users of the system. NRG states that the recent notifications of loss of underpressure during cell operations can largely be traced to the same underlying causes. NRG has taken organisational measures to improve staff awareness of changes in operating instructions, as well as user training. ANVS has assessed the results of the investigation and the proposed measures. It will supervise the implementation of these measures. In assessing the effectiveness of the measures taken, ANVS will be focusing in particular on the previously observed increased frequency of underpressure alarms during similar transport movements in the HCL. Based on the information provided by NRG, ANVS has definitively rated this event at INES level 0: no safety significance.

10 October 2016: HCL - Operations in hot cells while underpressure alarm system inoperative; INES level 0 (provisional rating)

On 10 October 2016, NRG reported that, on 27 September 2016, work was carried out in one of the Hot Cell Laboratories' (HCL) hot cells. At that point, due to maintenance work, a safety alarm system for sufficient underpressure in the hot cells was inoperative. The use of the hot cells is conditional on a functioning safety alarm system for sufficient underpressure. NRG has reported that while the work was in progress, the underpressure in the hot cells remained within specifications, thus the event has not had an impact on the staff and the immediate vicinity.

NRG is investigating the cause of this event. NRG reported this event to ANVS in a correct manner, and within the deadline set for this category. ANVS is assessing the result of the investigation into the cause of the event, and the measures proposed by NRG.

Based on the information available so far, ANVS has provisionally rated this event at INES level 0: a minor deviation. It will not be possible for a final rating to be assigned until the results of the investigation by NRG are known.

28 October 2016: MPF - Temperature of process oven deviated from value set out in safety specifications; INES level 0 (provisional rating)

During an inspection at the Molybdenum Production Facility (MPF), on 28 October 2016, an ANVS inspector noted that, at the start of a production round, the temperature of a process oven was not within the temperature range prescribed in the Safety Specifications (VTS). NRG has stated that the value specified in the VTS was out of date. Due to the introduction of a new type of oven, the necessity for the temperature condition was changed. Various safety checks were carried out when the oven was changed, and the working requirements were modified accordingly. However, the VTS requirement in question was not revised.

NRG provided supporting evidence to show that, at the temperature used, the production process is able to proceed in a safe and responsible way. Production was subsequently resumed. NRG will also send details of this evidence to ANVS, in writing. In addition, NRG is investigating the matter of why, when the oven was changed, the Safety Technical Specifications were not updated. A report of this event has also been formally submitted to ANVS.

Based on the information available so far, ANVS has provisionally rated this event at INES level 0: a minor deviation. The event will be assigned a final rating after assessment of the results of the further investigation.

31 October 2016: HCL - Deviation of outer packaging of filter in the fuel pool; INES level 0 (provisional rating)

On 31 October 2016, NRG reported that, on 17 October 2016, a deviation occurred while a filter from the Molybdenum Production Facility (MPF) was being transferred to storage in one of the Hot Cell Laboratories' (HCL) fuel pools. It emerged that this filter's extra outer packaging (pool container) was not sealed in a liquid-tight manner. In addition to the filter's normal leak-proof seal, the pool container in question serves as an extra seal. NRG has examined the pool container assembly and has made it leak-proof once again. NRG also reported that this had no impact in terms of safe operation and/or for NRG employees.

NRG reported this event to ANVS in a correct manner, within the deadline, and is now investigating the cause. ANVS is assessing the result of the investigation and the measures proposed by NRG. Based on the information available so far, ANVS has provisionally rated this event at INES level 0: a minor deviation. It will not be possible for a final rating to be assigned until the results of the investigation by NRG are known.

13 January 2017: NRG/MPF - Transport container's inner packaging not sealed during internal movement of radioactive materials; INES level 0 (provisional rating)

On 13 January 2017, NRG reported that, on 29 December 2016, the inner packaging of a transport container was found to have been improperly sealed while radioactive materials were being transferred between two workplaces. Because of the radiation involved, this type of work must be carried out remotely and out of the operator's direct line of sight. A deviation arose during this process. The radioactive materials in question were contained in sealed cans in the inner packaging. The defective seal was noticed while the container was being unpacked. NRG has indicated that the event had no impact on safety as far as the employees, the facility and the environment were concerned.

NRG is investigating the cause of this event. ANVS is assessing the result of the investigation into the cause of the event, and the measures proposed by NRG. It has also called NRG to account in connection with the late notification.

Based on the information available so far, ANVS has provisionally rated this event at INES level 0: a minor deviation. It will not be possible for a final rating to be assigned until the results of the investigation by NRG are known.

1.2.3 Central Organisation for Radioactive Waste (COVRA), Nieuwdorp (municipality of Borsele)

In 2016, the Central Organisation for Radioactive Waste (COVRA) reported no events to ANVS.

1.2.4 Higher Education Reactor (HOR), Delft

In 2016, Delft University of Technology (the licensee of the Higher Education Reactor) reported no events to ANVS.

1.2.5 Energy research Centre of the Netherlands (ECN), Petten

In 2016, the Energy research Centre of the Netherlands reported no events to ANVS.

1.2.6 Joint Research Centre (GCO) of the European Commission, Petten

In 2016, the European Commission's Joint Research Centre reported no events to ANVS.

1.2.7 Joint Nuclear Power Plant Nederland (GKN), Dodewaard

The Dodewaard nuclear power plant was definitively shut down on 26 March 1997, but it continues to be monitored, pending decommissioning. In 2016, GKN (the licensee of the Dodewaard nuclear power plant) reported one event to ANVS.

30 May 2016: Defective monitoring system for air passing through the ventilation system; INES level 0

On 30 May 2016, GKN (the organisation managing the Dodewaard nuclear power plant) reported that part of the tritium monitoring system for air passing through the ventilation system was defective. Pending repair, the ventilation system was shut down, to ensure that no unmonitored air is discharged from the ventilation system. The following day, GKN reported that the monitoring system was operational again and that the ventilation system was operating again.

All nuclear fuel from the Dodewaard nuclear power plant has been taken away for disposal. As a result of previous operations, some radioactive materials are still present in the facility. For this reason, the air passing through the ventilation system is monitored for the presence of radioactive materials, including tritium. The malfunction in the monitoring system was detected during the system's weekly inspection. The other monitoring systems for radioactive materials have continued to function normally. The defect was resolved well within the 30-day deadline. ANVS has rated this event as INES level 0: a minor deviation, because the defect was detected in time, all necessary measures were taken in a timely fashion, and the levels of tritium in the air passing through the ventilation system were very limited.

1.2.8 URENCO Nederland, Almelo

In 2016, URENCO reported no events to ANVS.

1.3 Dutch event reports to the IAEA in 2016

Events of INES level 2 and higher must be reported to the IAEA (International Atomic Energy Agency) by the more than seventy countries which participate in INES. The purpose of these notifications is to inform the international community, at an early stage, of the nature and severity of any such events. No INES notifications were made to the IAEA by the Netherlands for 2016.

The IAEA manages databases of events that have occurred at nuclear facilities⁹. Countries enter reports on the events in question into these databases, the objective being to actively inform one another of the causes of, and solutions for, events which, after all, can also occur at similar facilities and under similar circumstances in other countries. In 2016, a report was submitted by the Netherlands to the IAEA about an event which occurred at the Borssele nuclear power plant. The report concerned technical defects in the emergency power system. See the 2015 Report for details of the event that occurred on 13 May 2015.¹⁰

⁹ The databases can be found here: <http://nucleus.iaea.org/Pages/default.aspx>. Most of these databases are not accessible to the public.

¹⁰ <https://www.autoriteitnvs.nl/documenten/rapporten/2016/06/29/rapportage-ongewone-gebeurtenissen-in-nederlandse-nucleaire-inrichtingen-2015>.

2 Updating the information from previous reports

ANVS actively communicates details of any events at nuclear facilities on its website. This means that the allocation of a provisional INES rating is communicated even before the investigation into an event has concluded, and has been completed satisfactorily. Similarly, the investigations into some events are still underway when the events report is sent to the House of Representatives. Should the final reports on the events or future inspections of the licensees lead to a change in the number or INES rating of the reported events, this will be immediately updated at the website. This will be addressed in the following year's events report.

2.1 Completeness of the notifications to ANVS carried out by the licensees

The 2015 report was drawn up following the annual inspections of events at nuclear facilities. Accordingly, on this point, the report was complete and does not require any additions.

2.2 Updating provisional INES ratings

The 2015 report included various notifications and provisional INES ratings. Pending investigations by the licensees, some notifications have yet to be allocated a final INES rating. In no cases whatsoever did the final INES rating differ from the provisional rating.

3 ANVS analysis of events in the Netherlands in 2016

Chapter 2 contains details of all the events that the various Dutch nuclear facilities reported to ANVS in 2016. A number of questions must be answered before these events can be translated into an analysis of how the facilities are performing: How serious were these events? How did the licensees deal with them? Is the situation getting better or worse? How does the Dutch situation relate to the international state of affairs and are these events an indication of other possible safety problems?

For the purposes of information, Table 2 shows a summary of the events that occurred in the last ten years, from 2007 up to and including 2016. The information has been broken down into events at the KCB and those that occurred at other Dutch nuclear facilities. The table also contains a summary of all the events rated at an INES level higher than 0. Figure 1 on the next page shows this information in a graph.

Table 2: The number of events subject to a reporting requirement that occurred at the KCB and other nuclear facilities from 2007 up to and including 2016.

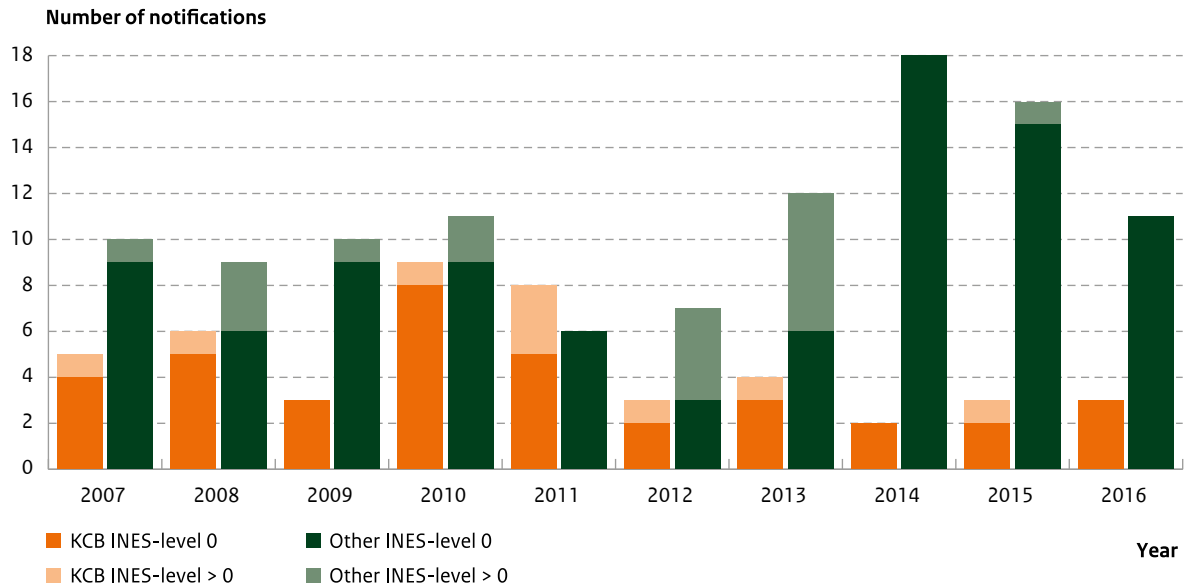
Year	TOTAL			INES > 0		
	Total	KCB	Other	Total	KCB	Other
2016 ¹¹	14	3	11	0	0	0
2015 ¹²	19	3	16	2	1	1
2014	20	2	18	0	0	0
2013	16	4	12	7	1	6
2012	10	3	7	5	1	4
2011	14	8	6	3	3	0
2010	20	9	11	3	1	2
2009	13	3	10	1	0	1
2008	15	6	9	4	1	3
2007	15	5	10	2	1	1

The first question, concerning the seriousness of these events, can be answered with the aid of the INES ratings that were assigned. When the INES scale was set up in 1989, the criteria for rating events at the different levels were specified on the basis that an average of around ten INES level 0 events and a single INES level 1 event could occur annually at a 'normal' nuclear facility. An INES level 2 event could occur once in ten years, on average.

¹¹ Ten events still have a provisional INES rating.

¹² Seven events still have a provisional INES rating.

Figure 1: The number of events subject to a reporting requirement that occurred at the KCB and other nuclear facilities from 2007 up to and including 2016.



The severity of events at Dutch facilities in 2016 was low, according to the benchmark that is used at international level. The 14 events which occurred in 2016 were, after all, characterised as ‘less serious’ (INES level 0). Incidentally, a number of events have yet to be assigned a final rating. It will not be possible to assign final ratings until the investigations into the underlying causes have been completed. Some complex investigations inevitably take longer than a year. This final rating is unlikely to be more than one level higher than the provisional rating.

Whether the situation at the nuclear facilities in 2016 is better or worse than in previous years and whether they perform better or worse than one another, or than facilities outside the Netherlands, is less easy to determine. The reasons are as follows:

- Statistics on the data are scarce. Given the relatively small number of facilities and events involved, it is not possible to reach an informed, statistically sound opinion.
- While the INES scale does give a reliable impression of the severity of a situation, it does not indicate whether, for example, two INES level 0 events are more or less serious than a single INES level 1 event.
- By international requirement, events must be rated at a minimum of INES level 2 before the country concerned is obliged to enter them in the INES system. Thus, an objective numerical comparison of INES levels 0 and 1 with other countries is not possible.
- The notification criteria always allow scope for ‘interpretations’. So while an increase in the number of notifications might actually reflect a greater willingness to report events, it could also be seen – perhaps incorrectly – as a worsening of the situation.
- The vast majority of events that are subject to a reporting requirement are covered by the INES scale. The specific notification criteria depend on what constitutes common practice in different countries, but they mainly depend on the specific technical details of the design of the various facilities. As a consequence, there are inevitably major differences in the notification criteria for different facilities.
- Based on the severity of the reported events in 2016, we can conclude that, on average, this was lower than the annual average for the last five years.

Taking this into account, the number of events which occurred at nuclear facilities in the Netherlands in 2016 and the severity of these events give no reason to intensify the focus on the safety situation at these facilities.

The question of whether the events reported have underlying causes will be discussed in the following two sections. The first section looks at the situation at the KCB and the second at other Dutch nuclear facilities.

3.1 Borssele Nuclear Power Plant

EPZ reported three events in 2016, all of which were rated at INES level 0 (two of these still have a provisional rating). This continues the trend seen in previous years, of a decline in the number and severity of events. In 2016, EPZ reported events in a timely manner and demonstrated a readiness to learn from these events, to reduce the likelihood of repetition. EPZ's final reports were of sufficient quality, but in some cases ANVS needed to ask additional questions or to be insistent, to get the reports completed correctly. Based on the information available at the time of writing, ANVS concludes that EPZ has learned sufficient lessons from the events, and that it is actively carrying out analyses and improvement plans. ANVS still has to carry out a specific inspection of the events at the Borssele nuclear power plant which, according to EPZ, were not subject to a reporting requirement. Should this inspection or the future completion of as yet unfinished events lead to other conclusions, then this will be addressed in the 2017 event report and at the ANVS website.

3.2 Other Dutch nuclear facilities

3.2.1 NRG

In 2016, NRG was only required to report a single event at the HFR. In response to this event and using adequate reasoning, NRG decided to shut the High Flux Reactor down as a precautionary measure, despite the fact that it was still possible to operate the reactor within technical specifications. The problem was analysed and then resolved in a satisfactory manner, and the reactor was restarted.

In 2016, NRG reported nine events at its other facilities. Thus, the number of events is in line with previous years. In addition, none of the events in 2016 were serious in nature. ANVS notes that NRG is giving notification more actively than in the past. In doing so, it is adhering more closely to the technical specifications that provide guidance about whether or not notification is required. Regarding the promptness with which ANVS is notified of events that are subject to a reporting requirement, as well as the speed and accuracy of the subsequent investigations, guidance from ANVS is still required. In a few cases, NRG has missed the notification deadline. ANVS notes that, in too many instances, NRG is taking too long to investigate events, and to produce the final reports. When this event report was submitted, ANVS asked NRG to produce a specific action plan indicating how it proposes to change this situation in the near future.

3.2.2 Dodewaard

In 2016, a single event occurred at Dodewaard nuclear power plant, which had already been closed. In this connection, GKN (the licensee of the nuclear power plant, which is in safe enclosure) has responded adequately and has submitted a report. The technical event was rectified well before the stipulated deadline elapsed.

3.3 General conclusion

The events (both the one subject to a reporting requirement and the one not subject to a reporting requirement) have prompted the companies to carry out an analysis to identify the direct and indirect causes. Where necessary, measures have been taken to prevent any recurrence in the future.

ANVS takes the view that the licensees in question make active use of the knowledge acquired in the analysis of events, with the objective of realising improvements.

ANVS stays abreast of the progress and effectiveness of the measures taken, carries out on-site inspections and, where necessary, applies enforcement instruments to promote compliance.

Based on the information available, ANVS concludes that, in general, the licensees of the nuclear facilities tackled the events which occurred at their facilities in 2016 with sufficient care. The policy of further limiting the number of events, which KCB and NRG implemented a few years ago, appears to be bearing fruit. Despite the fact that events are generally handled properly, dealing with them in a timely and careful manner is an area that still requires attention. In the case of the other NRG facilities, improvements will have to be made in the near future.

Appendix

The severity of nuclear events according to the International Nuclear and Radiological Event Scale (INES)

An estimate is made of the severity of all events which are subject to a reporting requirement. This involves the use of the International Nuclear and Radiological Event Scale (INES), devised by the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency (NEA), which is part of the Organisation for Economic Cooperation and Development (OECD). INES ratings, from level 1 (anomaly) rising to level 7 (major accident) are used to make the level of events at nuclear facilities all over the world clear to the general public, in consistent terms.

The INES rating is the result of three separate ratings:

1. radiation or radioactive material released,
2. harm to people and the living environment and
3. degradation of safety barriers.

The ultimate rating of an event is based on the highest rating of the three. When 'radiation or radioactive material released' and 'harm to people and the living environment' are rated, the actual consequences involved are examined. Measurements are taken of the amount of material ending up in the living environment or of how many people were exposed, and to what degree of radiation. However, radiation is seldom actually released during an 'incident' or 'accident' and no harm is caused to people or the environment. The purpose of the INES rating on the 'degradation of safety barriers' is to give an indication of the severity involved in that type of event, too. In this rating, the number of safety barriers that provide protection against the release of radiation is relevant. The height of this rating is then determined by the number of barriers still present. The fewer barriers that remain, the higher the rating. The severity of the event that could occur if the remaining barriers were not present also counts.

Almost none of the events in this report have had any actual consequences for people or the environment.

The following descriptions apply to INES levels 1 to 3:

- Level 1 is an 'anomaly'. Level 1 anomalies are events in which, for example, problems arise with a facility's safety provisions, but where the remaining safety margin is sufficient to prevent exposure to radiation. Another example of an INES level 1 anomaly is an event in which a member of the public is exposed to radiation from radioactive materials and the dose incurred exceeds the legally permitted dose in the Netherlands of 0.001 Sievert per year.
- Level 2 is an 'incident'. These are events in which, for example, heightened radiation levels occur in the workplace (more than 0.05 Sievert per hour). An event in which parts of the facility become severely contaminated with radioactive materials is also an INES level 2 incident.
- Level 3 is a 'serious incident'. These are events in which, for example, parts of the nuclear facility become very severely contaminated with radioactive materials. Another example of an INES level 3 serious incident is an event in which an accident is only just avoided and there is no remaining margin present in terms of safety features.

The higher levels have not been included in this report. Descriptions of the higher levels can be found on the ANVS website (see the link below).

No incidents of level 3 and higher have ever occurred at Dutch nuclear facilities.

Incidentally, the INES rating not only applies to events at nuclear facilities but also to events occurring during transports, work with radioactive sources, devices and materials and, since early 2007 (in a test phase), also for medical events. Non-civilian events and nuclear terrorism do not fall under the INES regime.

Events from INES level 2 must be reported to the IAEA by the more than seventy countries which participate in INES.

As a result of the recently acquired experience with the INES scale after the nuclear accident in Fukushima, the IAEA has investigated the INES scale to see whether it requires modification. The conclusion of the investigation was that the scale does not need modifying, but that those involved should be more cautious when assigning *provisional* ratings. A good rating can only be assigned once the accident has reached a stable phase and there is a reliable picture of the ultimate consequences. Member states are encouraged to make INES notifications within 24 hours. This period of 24 hours is, incidentally, counted from the point in time at which a reliable and stable picture of the situation has been established and not from the beginning of the accident.

The Nuclear Energy Act licence and, more particularly, the TS of a facility referred to in the licence stipulate the events which have to be reported to ANVS by Dutch nuclear facilities. The Dutch notification regulations are more *stringent* than those of INES. Licensees therefore also report events to ANVS which are not relevant under the INES criteria but which they still have to subject to a more detailed safety analysis.

These low-level events, which are not significant for nuclear safety and thus fall below this nuclear scale, are rated at INES level 0 or 'below scale'.

More information about the INES scale can be found on the ANVS website (<http://www.autoriteitnvs.nl/onderwerpen/ines>) and that of the International Atomic Energy Agency (<https://www.iaea.org/sites/default/files/ines.pdf> and <http://www-pub.iaea.org/MTCD/Publications/PDF/INES2013web.pdf>).

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