Autoriteit Nucleaire Veiligheid en Stralingsbescherming

Report on events in Dutch nuclear facilities during 2014

This document is a translation of the ANVS report "Rapportage ongewone gebeurtenissen in Nederlandse nucleaire inrichtingen in 2014".
The original report shall prevail in case of textual differences between the Dutch report and this translation.

Autoriteit Nucleaire Veiligheid en Stralingsbescherming

Colophon

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Executive summary

In 2014, twenty events[1] covered by the compulsory reporting requirements[2] occurred at Dutch nuclear facilities. Two of the events took place at the Borssele Nuclear Power Plant (NPP) and eighteen at other Dutch nuclear facilities (NRG and URENCO).

The number of events in 2014 was slightly higher than that in the preceding years: twenty, as opposed to an average of sixteen in the period 2010 to 2014.
The seriousness of seven of the events cannot yet be (definitively) classified, because further investigation is required. The other thirteen events have been classified by the Authority for Nuclear Safety and Radiation Protection (ANVS) as level 0 on the internationally recognised International Nuclear and Radiological Event Scale (INES) [3]. This implies that the nuclear safety was not threatened by the events in question. The reported events in 2014 were therefore less serious than those reported in 2013. In that year, seven events were classified as level 1 or higher.

There were no noteworthy event-related developments at Borssele NPP. As in previous years, few events occurred at the plant in 2014. The ANVS has observed that, for several years, the plant's operator (EPZ) has placed additional emphasis on minimising the number of faults. EPZ has invested in measures designed to improve the plant's performance and has improved internal communication and its working processes. Although it is too early to draw definitive conclusions, the relatively small number of reported events appears to reflect those initiatives. Naturally, the ANVS continues to monitor developments closely.

There were fourteen reported events at the facilities operated by NRG at Petten. The number of events was higher than the previous year, when there were eight. In 2014, the NRG facilities were subject to critical analysis as part of a special investigation. The analysis revealed a number of shortcomings, which were reported to the ANVS as events, in addition to the events associated with normal operations. NRG is investing to increase safety awareness within the organisation, leading to more (potentially) unsafe situations being noted. That trend is illustrated by the increase in the number of internally recorded so-called 'Potentially Unsafe Situations'.
The reported events at the NRG facilities were less serious than those that occurred in 2013. The ANVS will of course continue to monitor the particular situation at NRG Petten in 2015.
At the other Dutch nuclear facilities, one event occurred in 2014, at the URENCO plant. The occurrence of one event is consistent with the normal level of incidence.

On the basis of the available information, the ANVS concludes that the operators of the nuclear facilities dealt appropriately with the events that occurred in their facilities in 2014. The ANVS was informed promptly, the causes of the events were

[1] In the context of this report, an event is considered to be an event or fault that is potentially relevant for nuclear safety. Such events include almost all faults that the operator is required to actively report to the ANVS under the provisions of its Nuclear Energy Act licence, plus other events which, although not covered by a reporting requirement, are nevertheless considered to be relevant for nuclear safety.
[2] When the Annual Report of the Ministry of Infrastructure and the Environment was considered by the Dutch House of Representatives recently, it was stated that there had been nineteen events. Further analysis has since led to one further event being added to the list.
[3] For further information regarding INES, see the annex.

established and steps were taken to prevent recurrence.
The ANVS is involved in action taken to improve safety at Dutch nuclear facilities. It monitors the progress and effectiveness of the action taken, carries out on-site inspections and, where appropriate, uses its powers to enforce compliance with the provisions of Nuclear Energy Act licences.
The events that occurred in 2014 are detailed in the following table.

Facility	**Total number of events requiring reporting**	**INES level 0**	**INES level 1**	**INES level 2**
Borssele NPP	2	2[4]	-	-
High-Flux Reactor, Petten	9	9[5]	-	-
Other NRG facilities, Petten	8	8[6]	-	-
Central Organisation for Radioactive Waste, Nieuwdorp	-	-	-	-
Higher Education Reactor, Delft	-	-	-	-
Dutch Energy Research Centre, Petten	-	-	-	-
Joint Research Centre, Petten	-	-	-	-
Joint Nuclear Power Plant Nederland, Dodewaard	-	-	-	-
URENCO Nederland, Almelo	1	1[7]	-	-

[4] Classifications are provisional.
[5] Classifications are definitive.
[6] Four classifications are definitive, three classifications are provisional and one classification cannot yet be made.
[7] Classification is provisional.

1 Introduction

This report describes the events that occurred in Dutch nuclear facilities in 2014. On 27 February 1980, the then Minister of Social Affairs undertook to submit an annual written report to the Dutch House of Representatives regarding the performance of the Dutch nuclear power plants. Over the intervening years, the scope of the report has been widened to include all nuclear facilities in the Netherlands and the associated radiological laboratories.

In previous years, the report has been prepared by the Department of Nuclear Safety, Security, Safeguards and Radiation Protection (Kernfysische Dienst, KFD). The KFD was responsible for supervising all facilities in the Netherlands licensed pursuant to either Section 15a or Section 15b of the Nuclear Energy Act. With effect from 1 January 2015, the KFD was incorporated into the newly created Authority for Nuclear Safety and Radiation Protection (ANVS).
Hence, the events described in this report were in point of fact reported to the KFD. However, since the ANVS has superseded the latter organisation as supervisory authority, the events are for the purposes of this report considered to have been reported to the ANVS.

The government wishes to make information available to the public on a more active basis. Therefore, since the start of 2013, events occurring at nuclear facilities in the Netherlands have been reported on the website of the ILT. From now on, the reports will be published on the website of the ANVS instead.
This report covers reports made by the following licensees[8]:

- The Elektriciteits-Produktiemaatschappij Zuid-Nederland (EPZ), Borsele, operator of Borssele NPP
- The Nuclear Research and Consultancy Group (NRG), Petten, operator of the following two facilities:
  - The High-Flux Reactor (HFR)
  - The Low-Flux Reactor[9] (LFR), the Hot Cell Laboratories (HCL), consisting of the Research Laboratory (RL), the Molybdenum Production Facility (MPF), the Decontamination and Waste Treatment (DWT) facility and the Waste Storage Facility (WSF)
- The Central Organisation for Radioactive Waste (COVRA), Nieuwdorp;
- Delft University of Technology, operator of the Delft Reactor Institute (RID), the Higher Education Reactor (HOR), and the DELPHI sub-critical ensemble and laboratories
- The Dutch Energy Research Centre (ECN), Petten
- The Joint Research Centre (GCO) of the European Commission, Petten
- The Joint Nuclear Power Plant Nederland (GKN), Dodewaard, which was definitively withdrawn from service in March 1997 and is now in a state of safe containment
- URENCO Nederland, Almelo, operator of enrichment facilities

Previous annual reports also covered event reports made by Mallinckrodt Pharmaceuticals, Petten. Legally speaking, the plant operated by the latter company is not a nuclear facility, but it was subject to supervision by the KFD because of its location at the Petten Research Centre.
In order to ensure that Mallinckrodt Pharmaceuticals is treated in the same way as other comparable licensees, it has been decided that events occurring at the Mallinckrodt will no longer be included in the annual event report.

[8] The listed licensees may be divided into two groups: those licensed pursuant to Section 15b of the Nuclear Energy Act (EPZ, COVRA, RID, NRG-HFR, NRG (other facilities), GKN and URENCO) and those licensed pursuant to Section 15a, Section 29 and Section 34 of the Nuclear Energy Act (ECN and GCO).
[9] Operations at the Low-Flux Reactor ceased at the end of 2010. A permit for the reactor to be dismantled was issued on 18 December 2014.

2 Events in the Netherlands in 2014

This section describes the events that occurred at Dutch nuclear facilities in 2014. An event has two important features. First, there is the event itself, the nature and seriousness of which must be established, and the impact of which must be minimised. Second, there is the subsequent systematic analysis of the event, with a view to preventing repetition. Systematic analysis and preventive action are important for the continuous improvement of safety at nuclear facilities.

Events vary from relatively insignificant to very significant. All events are treated equally seriously, however. Even if an event is in itself 'minor', it may be a symptom of a more serious underlying problem. Furthermore, the simultaneous occurrence of multiple minor events can have significant implications. It is therefore essential that all events are carefully recorded and analysed. The licensees of nuclear facilities accordingly have a responsibility to record and analyse events. The ANVS's role is to supervise licensees' activities with a view to ensuring that they fulfil their responsibilities, starting from the moment that an event is reported.
The conditions of the licences issued to the operators of nuclear facilities under the Nuclear Energy Act require the licensees to report all important events. For each facility, reporting criteria are specified, defining the events that must be reported to the ANVS. The total number of events occurring at a facility will normally be higher than the number reported to the ANVS and subsequently detailed in an annual event report. The ANVS is informed of the 'other' events by phone, in monthly quarterly reports or annual reports, at meetings and during inspections, which take place announced and unannounced throughout the year.

Reported events are given an INES classification (INES is the International Nuclear and Radiological Event Scale). The INES is to nuclear events what the Richter scale is for seismological events, namely a standardised expression of the event's seriousness. More information about the INES is provided in annex A.

2.1 Borssele Nuclear Power Plant (NPP), Borsele

In 2014, EPZ, the licensee of Borssele NPP, reported two events to the ANVS. The events in question are described below.

<u>17 November 2014: Calibration of emergency cooling water system instrument on two non-permitted occasions; INES level 0 (provisional classification)</u>
On 17 November 2014, in the context of a documentary audit, EPZ discovered that on 16 April 2014 an instrument had apparently been calibrated at Borssele NPP while the power plant was operating. The function of the instrument in question is to measure the quantity of cooling water flowing through the backup emergency cooling water system. The purpose of this calibration is ensure that quantitative data obtained regarding the cooling water flow are accurate. The backup emergency cooling water system serves to cool the reactor in the event of an accident causing the primary emergency cooling water system to cease functioning. Neither system is in use during normal operations.
The power plant's Technical Specifications state that calibration must be performed only when the reactor is shut down. That is the case only when the fuel rods are changed each year. Two factors contributed to calibration taking place while the plant was operating. First, the period when the plant was to be shut down for the fuel rods to be changed was rescheduled, but the calibration was not rescheduled accordingly. Second, the personnel responsible for performing the calibration were

unaware that the procedure should not be performed while the plant is operating. Further investigation revealed that a similar departure from the Technical Specifications had occurred a year earlier, on 22 October 2013.
Calibration of the instrument takes roughly ten minutes and does not interfere with the operation of the backup emergency cooling water system itself. The only implication is that the cooling water flow cannot be measured while calibration is in progress.
EPZ is currently investigating how the departure from the Technical Specifications was able to happen twice. The ANVS will assess the results of the investigation in due course; pending that assessment, the event has been provisionally classified as INES level 0: no safety significance.

21 November 2014: Incorrect performance of test on emergency power supply system; INES level 0 (provisional classification)
On 21 November 2014, EPZ reported that a test on part of the emergency power supply system at Borssele NPP had been performed in an irregular fashion, insofar as the requirements of the power plant's Technical Specifications had not been fully complied with.
The relevant part of the emergency power supply system generates direct current for the instruments and the power plant's safety controls when the primary DC supply is unavailable.
During the test, more voltage sources were simultaneously disconnected than the Technical Specifications permit. The emergency power supply system would nevertheless have been capable of supplying power if that had been necessary.
EPZ is currently investigating why the test was performed incorrectly. The ANVS will in due course assess the results of the investigation; pending that assessment, the event has been provisionally classified as INES level 0: no safety significance.

2.2 Other Dutch nuclear facilities

2.2.1 NRG High-Flux Reactor (HFR), Petten

In 2014, there were nine events at the HFR, which were reported to the ANVS.

24 January 2014: Internal irradiation capsule leak; INES level 0
On 24 January 2014, NRG reported an internal leak in the reactor. Cooling water from the reactor was flowing into the reactor pool through a flaw in a welded joint. As a result of the leak, the water in the reactor pool was contaminated with radioactive material. Maximum permitted levels are defined for leaks, and the detected leak exceeded the relevant level.
The defective weld was in an irradiation capsule. Each operating cycle involves the placement of objects in the reactor to irradiate them. Some objects are placed in the affected irradiation capsule. In its report, NRG stated that its investigations had revealed that the wall of the irradiation capsule had been leaking since 2009.
NRG immediately took the relevant capsule out of service and repaired it. NRG has since implemented measures to prevent recurrence.
The ANVS has classified the event as INES level 0: no safety significance.

24 January 2014: Tardy reporting of cooling water flow measurement system modification to the ANVS; INES level 0
On 24 January 2014, in the context of a documentary audit, NRG discovered that a modification had been made to the system which measures the speed of the cooling water flow through the reactor. The matter was reported to the ANVS because the modification procedure had not been followed correctly. All such modifications must

be reported to the ANVS in advance, and that had not happened. The procedural error was not detected until 2014, during the Return to Service programme (see 3.2.1).
Before the modification was made, the company's internal approval procedure had otherwise been followed. Hence, for example, NRG's Reactor Safety Committee had approved the modification. However, depending on the significance of the modification, the approval procedure should conclude either with approval being sought from the ANVS, or with the ANVS being informed of the modification in advance. In this case, the ANVS should have been informed in advance.
Following discovery of the procedural error, NRG reversed the modification and improved its internal modification procedure. The ANVS has classified the event as INES level 0: no safety significance.

2 February 2014: Tardy reporting of modification to irradiation object lock to the ANVS; INES level 0
On 2 February 2014 in the context of a documentary audit, NRG discovered that, in 2012, modifications had been made to the way in which certain irradiation objects were secured in the reactor prior to irradiation, without informing the ANVS in advance. The modifications were intended to improve the way that objects are secured. The modified method reduces the likelihood of damage and prevents small objects falling into the pool. The modifications therefore increase safety.
NRG was under the misapprehension that such modifications did not have to be reported to the ANVS. The ANVS has informed NRG that such modifications are covered by the reporting requirement. As indicated above in connection with the event of 24 January 2014, NRG has since improved its internal modification procedure.
The ANVS has classified the event as INES level 0: no safety significance.

13 March 2014: Leak from a pipe carrying radioactive waste water; INES level 0
On 13 March 2014, NRG reported that, on 9 March 2014, a leak had been discovered in the pipe that carries radioactive waste water from the High-Flux Reactor (HFR) to NRG's Decontamination and Waste Treatment (DWT) plant. A joint in the pipe had failed, probably as a result of corrosion. The slightly radioactive water leaking from the joint had run into a collection basin. A fluid alarm in the basin then alerted the operator to the existence of a leak. When inspected by the ANVS, the basin was found not to be watertight. Consequently, radioactively contaminated water could have seeped into the soil.
NRG subsequently extracted the fluid from the basin using a mobile vacuum system. During that process, a small amount of the contaminated fluid flowing along the vacuum hose leaked from defective joint in the mobile system and found its way into the soil. Measurements performed by NRG the following day detected no radioactivity in the collection basin or the soil.
NRG has taken steps to rectify the situation. NRG has installed drip trays beneath the pipe so that, in the event of any future leak, fluid cannot soak into the soil.
The ANVS has classified the event as INES 0: no safety significance.

22 May 2014: Escape of fuel rod capsule during neutrography; INES level 0
On 22 May 2014, NRG reported that, during preparations for taking a neutrogram of a fuel rod, the capsule containing the fuel rod came free from the neutrograph's retaining system. Neutrography is an imaging technique based on the use of neutrons. The capsule still contained some air, causing it to float up through the reactor pool. The capsule lodged beneath a cooling water pipe roughly four metres below the surface of the water. The air inside the capsule was released in a controlled manner, after which its own weight caused it to return to the normal,

vertical, position.
NRG analysed the incident and took steps to prevent recurrence. The incident had no implications for nuclear or occupational safety and has been classified by the ANVS as INES level 0: no safety significance.

15 July 2014: Calculation of maximum permissible temperature of cooling water prior to introduction to the core on the basis of an erroneously high value for some years; INES level 0
On 15 July 2014, NRG reported that the maximum temperature permissible for cooling water prior to its introduction to the reactor core had been incorrectly calculated since 2006. An erroneously high value had been used for the pressure differential across the core. The pressure differential across the core is an indicator of how quickly the cooling water is flowing through the core and therefore how much the water will heat up during its passage. In order to be sure that the heat generated in the core is properly dissipated, the cooling water must not be too hot at the point of entry to the core. The entry temperature of the cooling water is therefore measured and, if it is found to exceed the defined maximum, the reactor output is automatically reduced. The trigger temperature for reducing the output is recalculated at the start of each operating cycle.
After a modification to the HFR's cooling system in 2006, the pressure differential across the core decreased, but the value used to calculate the maximum permissible cooling water entry temperature was not adjusted accordingly.
NRG has now established that, due to use of the unadjusted value, the maximum permissible cooling water entry temperature has since 2006 consistently been set a few degrees higher than it should have been. NRG has demonstrated that the inaccuracy is within the accepted safety margins. The ANVS accepts that view.
Immediately following discovery of the error, NRG adjusted the value used for the pressure differential across the core and took steps to prevent any recurrence of the failure to fully consider the consequences of the modifications to the cooling system.
The ANVS has classified the event as INES level 0: no safety significance.

2 October 2014: Irradiation objects incorrectly secured in the reactor; INES level 0
On 3 October 2014, NRG reported that, when the reactor was unloaded on 2 October 2014, it was found that five irradiation capsules had been incorrectly secured inside the reactor. For each operating cycle, a number of objects are placed inside the reactor in order to irradiate them. Some such objects are placed in an irradiation capsule. NRG reported that, when the capsules were loaded into the reactor in September 2014, the 'dummies' were not loaded with them.
NRG has investigated the cause of this event and has taken steps to prevent recurrence.
The ANVS has classified this event as INES level 0: no safety significance.

13 October 2014: Exposure of personnel to radioactive radiation; INES level 0
On 13 October 2014, NRG reported that, when the reactor was shut down for periodic maintenance, four personnel were exposed during the ensuing maintenance activities to an amount of radioactive radiation exceeding the procedural maximum. The workers' personal radiation alarms did activate, but the four individuals did not stop working. Tests carried out after the four had finished their work indicated that the radiation doses received by the four were within the legal limits, implying that there had been no unacceptable risk to the health of the personnel in question.
The cause of the exposure was the unexpected presence of a highly activated metal object in a tank in the room where the four were working. This object's presence was not detected before work began, because radiation levels in the room were not checked properly.

NRG has investigated the circumstances of the reported event and has taken steps to prevent recurrence. The steps in question address both the timely detection of radiation sources in the workplace and the response to personal radiation alarms. The ANVS has this event classified as INES level 0: no safety significance.

5 December 2014: Fault in one of the instrument systems used to monitor the fission process; INES level 0
On 5 December 2014, NRG reported that, when the HFR was started up on 4 December 2014, it was found that the remote monitoring system (RMS) was not working. The cause was a faulty sensor.
The RMS allows the HFR'S critical process parameters to be monitored in the event of the HFR control room being unavailable in an emergency. During the planned reactor start-up, the RMS's display panel was not showing any information about the fission process in the core. In the control room itself, all the sensors were working and all the relevant parameters could be monitored. Immediately after the reactor start-up, the output of one of the four control room fission process sensors was diverted to the RMS display, so that the data would be visible there too in the event of an emergency.
The diversion was made once the start-up was complete, so that data from all the sensors remained available in the control room for the full duration of the start-up procedure. Under the Safety Technical Specifications, the diversion of instrument output is permissible for a short period. On 23 December 2014, NRG deployed a backup system and reversed the temporary signal diversion. Reversal of the temporary diversion took place within the time limit permitted by the Safety Technical Specifications.

NRG is currently investigating the cause of the instrument failure.
The ANVS has classified this event as INES level 0: no safety significance.

2.2.2 Other NRG facilities[10], Petten

In 2014 seven events at the other NRG facilities were reported to the government.

24 January 2014: Poor performance of the carbon filter cartridge in the ventilation system of the DWT Water Treatment Building; INES level 0 (provisional classification)
On 24 January 2014, NRG reported that a periodic test had revealed that efficiency of the carbon filter cartridge in the ventilation system of the Water Treatment Building was below the required level. In the building, which is part of NRG's Decontamination and Waste Treatment (DWT) plant, various substances are treated, including waste water and sludge-like waste. The wastes in question are radioactive. In the event of an incident in the building, gaseous radioactive material can enter the atmosphere of the building under certain circumstances. The carbon filter cartridge in the ventilation system serves to prevent such material, particularly iodine (I-131), escaping into the air outside the building in the event of such an incident. If the efficiency of the carbon filter cartridge is below the required level, radioactivity could escape into the air outside the building if such an incident were to occur. Because no such incident involving the release of radioactivity has occurred

[10] The other facilities for which NRG has licences are the HCL (Hot Cell Laboratories), consisting of the Research Laboratory (RL) and the Molybdenum Production Facility (MPF), the LFR (Low-Flux Reactor), the WSF (Waste Storage Facility), the DWT (Decontamination and Waste Treatment plant) and various other laboratories, including the Jaap Goedkoop Laboratory (JGL).

during the years that the cartridge has been in service, its impaired efficiency has not had any consequences for emissions to the environment.
The ANVS regards the fault as undesirable and avoidable. Investigations have since revealed that the poor performance of the carbon filter cartridge had been observed for several consecutive years without NRG taking any structural corrective action. Furthermore, the fault was not previously reported to the ANVS, contrary to the licence conditions.
NRG is now working on a structural solution of the problem. In addition, NRG has taken a series of steps to ensure that similar issues are immediately addressed in future.
The ANVS has provisionally classified the event as INES level 0: no safety significance.

24 January 2014: Failure to perform compulsory leak tests on MPF production cells; INES classification pending
On 24 January 2014, NRG reported that a general audit had revealed that certain compulsory tests had not been performed. The tests in question were tests for the presence of leaks from the production cells in NRG's Molybdenum Production Facility (MPF). The requirement to perform the tests is contained in the Safety Technical Requirements.
The production cells are used for various procedures that involve radioactive material. The cells must not leak and must fulfil various other criteria, in order to ensure that radioactive material cannot escape. Hence, tests must periodically be performed to verify that the cells do not leak. However, the audit revealed that no such tests had previously been performed.
The ANVS regards the failure to perform the leak tests as the undesirable removal of a safety barrier.
NRG has since defined leak test procedures and has started performing the required tests. The first tests revealed that a few production cells did not satisfy the leakage criteria. Repairs have since been performed to the cells in question, so that they do now satisfy the criteria. In addition, NRG has taken a series of steps to ensure that similar issues are immediately addressed in future.
The cause of the failure to perform the leak tests is not yet known. The ANVS is making further enquiries with a view to arriving at an INES classification.

24 January 2014: Unsound MPF floor; INES level 0
On 24 January 2014, NRG reported that a general audit had revealed cracks in a floor in NRG's Molybdenum Production Facility (MPF). NRG reported that the cracks probably formed after 1996, when certain heavy objects were placed on the floor. The placement of the objects resulted in the floor being subjected to loads in excess of those for which it was designed. The building is used for activities that involve the use of radioactive material.
NRG has taken structural steps to ensure that the floor satisfies the requirements once more.
The ANVS has classified the event as INES level 0: no safety significance.

24 January 2014: Fault in MPF double-wall radioactive waste storage system; INES level 0 (provisional classification)
On 24 January 2014, NRG reported that a periodic test had revealed that the outer wall of a storage system for radioactive waste was leaking. Such storage systems have double walls as an additional precaution to prevent radioactivity escaping in the event of a flaw in one of the walls. A storage system of this kind consists of a tank and connected pipework. Because the system's inner wall remained intact, no contamination of the storage area or its surroundings occurred.

The storage system was taken out of service pending further instructions. NRG is currently investigating the possibility of the storage system being repaired and returned to service in the future.
The ANVS is supervising NRG's investigations and will perform a safety assessment before allowing NRG to return the storage system to service. The ANVS has provisionally classified the event as INES level 0: no safety significance.

6 February 2014: Start-up fault with emergency power generator in DWT Water Treatment Building; INES level 0
On 12 February 2014, NRG reported that on 6 February 2014 it had been observed that the emergency power generator in the DWT Water Treatment Building was suffering from a technical fault. The generator serves to supply power for the building's ventilation system in the event of the primary system's failure.
In a routine monthly test, the generator had failed to start. As a result, the accommodation areas of the building had no ventilation for five minutes. No one was present during the relevant period and no radioactivity escaped into the exterior atmosphere. An investigation revealed that the generator's diesel motor had failed to start because of air in the fuel line.

The diesel motor was examined, repaired, retested and passed as ready for service on the day that the fault was detected. As a precaution, the testing interval for the emergency power generator was reduced from once a month to once a week.
The ANVS has classified this event as INES level 0: no safety significance.

27 October 2014: Disablement of ventilation due to non-availability of emergency power supply; INES level 0 (provisional classification)
On 27 October 2014, NRG reported that it had subsequently been discovered that during the annual electrotechnical maintenance activities on 18 June 2014 the ventilation in the DWT Water Treatment Building had been accidentally disabled for roughly thirty minutes. NRG's Water Treatment Building is used for decontamination and recycling activities, which can lead to the release of radioactive material, which then enters the ventilation system, where it is filtered out.
The ventilation system ceased to function because a diesel generator, which supplies emergency power supply to the ventilation system, had not taken over the supply as intended. After becoming aware that the ventilation had been disabled, NRG prohibited access to the radiological zones in the Water Treatment Building.
NRG is currently investigating the cause of the malfunction of the emergency power supply and the reason for the failure to report the incident to the ANVS more promptly.
The ANVS is awaiting the outcome of the investigation. Pending the outcome, the ANVS has provisionally classified this event as INES level 0: no safety significance.

12 November 2014: Malfunction of Waste Storage Facility airborne particulate activity monitoring system; INES level 0
On 12 November 2014, NRG reported to the ANVS that on 4 November 2014 it had been observed that the continuous airborne particulate activity monitoring system for the Waste Storage Facility (WSF) was malfunctioning. The WSF is NRG's operational facility where radioactive waste is temporarily stored before being transported to COVRA. The airborne particulate activity monitoring system continuously monitors the activity of particulate material suspended in the air of the operations area, so that appropriate action may be taken promptly in the event of radioactive contamination. The WSF's Safety Technical Specifications state that the continuous airborne particulate activity monitoring system must be functioning properly.

Initial investigation by NRG revealed that the WSF's airborne particulate activity monitoring system had not been functioning properly since 18 July 2014. When the problem came to light, work in the WSF was suspended. The airborne activity monitor was replaced, after which activities in the WSF were resumed on 6 November 2014.
NRG has taken steps to ensure that any future problems with the airborne particulate activity monitoring system are identified promptly.
The ANVS has classified this event as INES level 0: no safety significance.

28 November 2014: Radioactive waste container not properly closed when moved; INES level 0
On 28 November 2014, NRG reported that while a container holding radioactive material was relocated within the WSF, one of the container's access hatches came open. As a result, the personnel moving the container were exposed to a higher radiation dose than normal during such activities. The radiation doses received by the personnel were within the legal limits.
NRG has implemented procedural measures to prevent recurrence and is working on changes to the design of the container, to reinforce the procedural measures.
An investigation into the cause of this event has started and the relocation of containers within the WSF has been suspended pending further instructions.
The ANVS has classified this event as INES level 0: no safety significance.

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

No events that required reporting occurred at COVRA in 2014.
With regard to events that occurred in previous years, the following information is provided:

- Conditioned waste with abnormalities
  As part of an inspection campaign, in 2013 COVRA assessed the quality of the packaging of conditioned waste and established that some drums had flaws. The drums in question had inadequate concrete covers, with the result that waste material protruded above the concrete, which is not permitted. COVRA accordingly initiated action with a view to establishing how many drums exhibited the flaw and improving the packaging of the waste material in question.
  The storage arrangements for the radioactive material remained safe despite the issue, because the drums are stored in controlled concrete facilities.
- Formation of hydrogen in cylinders containing highly radioactive waste
  In the Report on Events in Dutch Nuclear Facilities during 2012, it was reported that in November 2012 COVRA had discovered hydrogen gas in storage cylinders used for highly radioactive waste. The presence of the gas (in very low concentrations) was unexpected and is not permitted. Following the discovery, COVRA undertook an investigation to establish how the gas had formed and how recurrence could be prevented. The investigation has since confirmed the hypothesis that the hydrogen gas originated from the decomposition of the very small quantities of water vapour present in the storage facility. It has also become clear that the welded seams of the storage cylinders in question have very small flaws, which allow the passage of material. Efforts to identify the cause and a structural solution are still in progress.
  The storage arrangements for the radioactive material remained safe despite the issue, because the cylinders are stored in specially designed facilities.
- Treatment of molybdenum production waste
  COVRA receives radioactive waste from the production of molybdenum (a radioactive isotope used for medical purposes) and encases the waste in

concrete. The waste is sent by NRG. The arrangements for the storage and transportation of this waste at NRG's Petten facilities are described in the Report on Events in Dutch Nuclear Facilities in 2013.
Doubts had arisen regarding the composition of consignments of waste of this type originating from Petten in recent years. COVRA therefore carried out an investigation into the potential safety implications for storage and processing of the waste at its facilities. Measures were implemented with a view to determining the composition of the waste sooner and more precisely. The measures in question mainly involve the cleaning of processing equipment and improving the test activities with a view to ensuring that waste is not accepted (any more) if it does not satisfy the quality requirements.

2.2.4 Higher Education Reactor (HOR), Delft

No events that required reporting occurred at the Higher Education Reactor in 2014.

2.2.5 Dutch Energy Research Centre (ECN), Petten

No events that required reporting occurred at the Dutch Energy Research Centre in 2014.

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

No events that required reporting occurred at the Joint Research Centre of the European Commission in 2014.

2.2.7 Joint Nuclear Power Plant Nederland (GKN), Dodewaard

The Dodewaard Nuclear Power Plant was definitively taken out of service on 26 March 1997. The fuel was removed from the reactor and transported elsewhere. Redundant systems were closed down and cleaned as necessary. The power plant was then shut down. The inactive systems underwent preservative treatment and were locked. Structural changes were made to the buildings and new systems were installed. On 1 July 2005, a waiting period of forty years began, at the end of which the power plant will be dismantled.
No events that required reporting occurred at the Dodewaard Nuclear Power Plant in 2014.

2.2.8 URENCO Nederland, Almelo

At URENCO, one event occurred in 2014, which was reported to the ANVS.

<u>22 September 2014: Failure of standby air purification system to activate in response to failure of primary air purification system; INES level 0 (provisional classification)</u>
On 22 September 2014, URENCO reported that on 23 August 2014 the standby air purification system serving the Central Services Building had not automatically activated when the primary air purification system ceased to function. The Central Services Building is used for various activities, such as waste water treatment, cylinder cleaning and sample analysis. Radioactive material released into the facility's atmosphere in the course of the activities is removed by the air purification system, thus preventing dispersal to other areas or to the exterior atmosphere. In view of the importance of the air purification system, a backup system is available, which takes over the purification in the event of the primary system ceasing to function. Investigations revealed that the backup system's failure to start up was a side-effect of an earlier modification to the system. URENCO is currently investigating the underlying cause.
The ANVS is awaiting the outcome of the investigation. Pending the outcome, the ANVS has provisionally classified this event as INES level 0: no safety significance.

2.3 Dutch event reports to the IAEA in 2014

Countries that participate in the INES regime (of which there are more than seventy) are obliged to report events of INES level 2 and above[11] to the IAEA (International Atomic Energy Agency). The purpose of the reporting system is to ensure that the rest of the world is promptly informed about the nature and seriousness of any events that have occurred. In 2014, no events occurred in the Netherlands that required reporting to the IAEA.
The IAEA maintains databases of events occurring at nuclear facilities[12]. Affiliated nations enter information about events into the databases, in order to keep each other actively informed about the causes of and the solutions to faults which may occur in similar facilities and circumstances elsewhere.
In 2014, the Netherlands informed the IAEA about an undesirable event at Borssele NPP: the occurrence of a small leak in the reactor's primary system, like that which occurred in August 2011 as a result of local corrosion. The event in question was reported in the Report on Events in Dutch Nuclear Facilities during 2011.
The Netherlands also informed the IAEA about an error in a safety analysis of the HFR performed in February 2013. The event in question was reported in the Report on Events in Dutch Nuclear Facilities during 2013.

[11] See note 3.
[12] The databases are accessible via the following URL: http://nucleus.iaea.org/Pages/default.aspx. Most of the databases are not public.

3 ANVS analysis of events in the Netherlands in 2014

Section 2 of this report describes the events that occurred at the various Dutch facilities in 2014. In order to translate the facts into an analysis of the facilities' performance, a number of questions must be answered: How serious were the events? How did the licensees deal with these events? Is the situation improving or deteriorating? How does the situation in the Netherlands compare with that in other countries and are the events indicative of other potential safety problems?

Table 1 provides an overview of events occurring between 2005 and 2014, broken down into those occurring at Borssele NPP and those occurring at other Dutch nuclear facilities. The table shows both totals and numbers of events classified as higher than INES level 0. The same data is presented in graphical form in figure 1.

	TOTAL			INES > 0		
Year	Total	Borssele NPP	Other	Total	Borssele NPP	Other
2014	20	2	18	0[13]	0[14]	0[15]
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
2006	25	17	8	3	1	2
2005	23	13	10	4	2	2

Table 1: Numbers of events occurring at Borssele NPP and other nuclear facilities over the last ten years.

The first of the questions referred to above – how serious were the events? – can be answered by reference to the reported INES classifications.
When the INES was introduced in 1989, the criteria for classification at the various levels were formulated so that a 'normal' nuclear facility was likely to experience an annual average of roughly ten INES level-0 events and one INES level-1 event. An INES level-2 event should on average occur only once every ten years.

On the basis of that international index, the seriousness of the events occurring at Dutch facilities in 2014 was very low, therefore. The twenty reportable events recorded in 2014 were all 'less significant' ('below scale', INES level 0). By way of qualification, it should be pointed out that seven of the twenty events still await (definitive) classification. Definitive classification is not possible until the cause of an event has been fully investigated, which can sometimes take more than a year.

[13] This figure is provisional because some events still await (definitive) classification. Definitive classification is not possible until the cause of an event has been fully investigated, which can sometimes take more than a year.
[14] See note 13.
[15] See note 13.

It is not easy to ascertain whether the situation at the Dutch nuclear facilities was better or worse in 2014 than in previous years, or whether the Dutch nuclear facilities performed better or worse than facilities in other countries. The reasons are as follows:

- The data are statistically limited: there were too few events to make statistically valid judgements.
- While INES is a valuable indicator of an event's seriousness, assessment of the overall situation remains subjective: do two level-0 events constitute a more serious or less serious situation than one level-1 event, for example?
- The international obligation to log issues in the INES system applies only in respect of events of INES level 2 or higher. Hence, objective statistical comparison of level-0 and level-1 events occurring in the Netherlands with those occurring elsewhere is not possible.
- The reporting criteria are always open to interpretation. Consequently, an increase in the number of reports may reflect a greater inclination to report incidents, rather than a deterioration in the situation.

Subject to the qualifications outlined above, neither the nature nor the number of the reported events occurring at Dutch nuclear facilities in 2014 give cause for concern regarding the safety of the facilities in question.

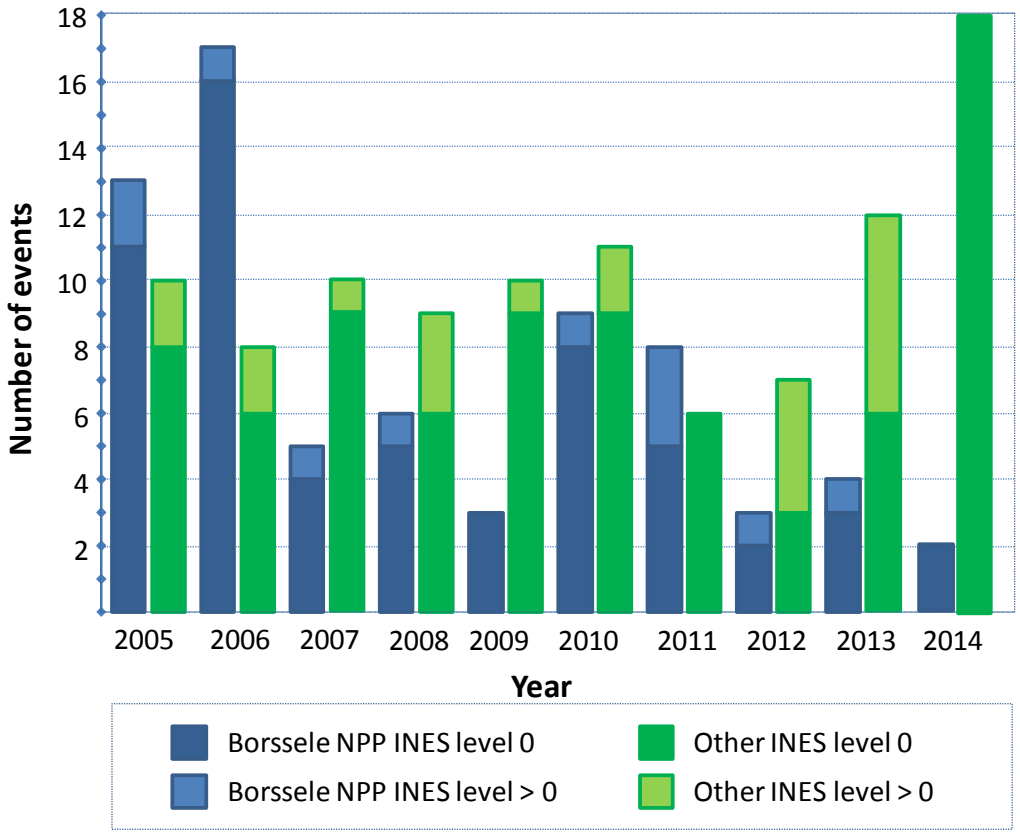

Figure 1: The numbers of events occurring at Dutch nuclear facilities between 2005 and 2014 that required reporting.

The question of whether the reported events are indicative of underlying safety issues is considered in the following two subsections. The first subsection deals with the situation at Borssele NPP and the second with the situation at the other Dutch nuclear facilities.

3.1 Borssele NPP

EPZ reported two events in 2014, both of which have been classified as INES level 0. It was the third consecutive year in which the number of events was low in comparison with previous years. The relative seriousness of the events (the INES classification) was in line with previous years.
On the basis of the available information, the ANVS concludes that EPZ dealt appropriately with the events that occurred at Borssele NPP in 2014. The events were promptly reported and analysed, and the causes were established.
EPZ has been able to demonstrate that it seeks to learn from the events that occurred and that steps were taken where necessary to prevent recurrence.
The ANVS is of the opinion that EPZ has drawn appropriate lessons from the events that occurred in 2014, is actively undertaking further research and has made appropriate improvements. The ANVS continues to monitor the progress and effectiveness of the improvement programmes put in place, carries out on-site inspections and, where appropriate, uses its powers to increase compliance with the applicable requirements.

3.2 Other Dutch nuclear facilities

3.2.1 NRG

In 2014, NRG reported seventeen events to the ANVS. The number of reported events was higher than in previous years. The events reported in 2014 were minor in terms of their seriousness. On the basis of the information currently available, all the events in question have been classified as INES level 0.
The relatively large number of events at NRG that required reporting may be attributed to activities that NRG started in response to a number of incidents in 2012 and 2013, which were reported in the event reports for previous years. In November 2013, NRG launched a Return to Service programme. One the programme's aims was to increase the reliability of the NRG facilities. The programme began with the controlled cessation of all activities at the facilities operated by NRG. NRG then proceeded to make changes to the technical installations, the safety systems and the organisational arrangements. To that end, NRG engaged external experts to advise on matters of organisation, safety culture, system analysis, aging management and the management system. In the early part of 2014, NRG resumed operations at its facilities. NRG has stated that it intends to maintain its intensified focus on the reliability of its facilities and operations by implementing a Return to Reliability programme to follow up the Return to Service programme.
Six of the reports made in January 2014 related to longstanding issues that came to light as a result of the analyses performed by NRG in the context of the Return to Service programme. Moreover, safety awareness within the organisation was raised, resulting in further issues being reported later in 2014, which may have been present for some time. The increased safety awareness is also reflected in a doubling of the number of internal reports of Potentially Unsafe Situations (POS). POSs include both nuclear events and occupational health and safety issues, which are reported within NRG. POSs are addressed immediately and a detailed analysis of the underlying causes is initiated where warranted by the nature and seriousness of the issue in question. Most POSs do not require reporting to the ANVS.
As the number of reports has increased, the capacity available within NRG for analysis of the events has come under pressure. As a result, the quality and promptness of the event analyses has been variable. NRG has accordingly set up a dedicated team to handle event reports. Significant company-wide improvements made in response to events reported to the ANVS and to internal POS reports include revision of NRG's modification procedure and procurement procedure.

The ANVS concludes that NRG is making good progress in terms of its ability to analyse and learn from events. The measures described above are expected to result in the backlog in the analysis of internal POSs being cleared in the near future.
In 2012, supervision of NRG was intensified. The ANVS is maintaining the intensified supervision regime for the time being, with a view to ensuring that NRG continues to make the required progress.

3.2.2 Other nuclear facilities

At the other nuclear facilities, one event occurred in 2014 that required reporting. That event was at the URENCO facilities and has been classified as INES level 0. The occurrence of a single event is consistent with the pattern seen in previous years.

Both the event that required reporting and those that did not triggered analyses by the licensees, leading to identification of the direct and indirect causes. Where necessary, steps were taken to prevent recurrence.
The ANVS is of the opinion that the licensees in question have learnt lessons from the events with a view to realising improvements.
The ANVS continues to monitor the progress and effectiveness of the implemented measures, carries out on-site inspections and, where appropriate, uses its powers to increase compliance with the applicable requirements.

On the basis of the available information, the ANVS concludes that, broadly speaking, the operators of the nuclear facilities dealt appropriately with the events that occurred at their facilities in 2014. Almost all events were reported within the time limits specified in the licence conditions and were properly analysed and the causes established.
The licensees were all able to demonstrate that they seek to learn from the events that occur and that they take action where necessary to prevent recurrence.

Autoriteit Nucleaire Veiligheid en Stralingsbescherming

Annex INES classification

All events that are covered by the compulsory reporting requirements are classified according to their seriousness. Classification is made using the International Nuclear and Radiological Event Scale (INES) of the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency (NEA) of the Organisation for Economic Cooperation and Development (OECD). The INES classification serves to describe the severity of events at nuclear facilities around the world to the public in consistent terms. The classifications range from level 1 (the least serious) to level 7 (the most serious).

A facility's Nuclear Energy Act licence (and more specifically the Technical Specifications that the licence refers to) specify which events must be reported. The Dutch rules for reporting are more stringent than those of INES. Consequently, licensees are required to report and perform detailed safety analyses in connection with certain types of event that would not be deemed significant on the basis of the INES criteria. Minor events of the types in question, which are not significant for nuclear safety and do not therefore warrant classification on the INES, are classified as 'INES level 0', or 'below scale'.

An INES classification is in fact the product of three subordinate classifications, relating to: 1. the release of radiation or radioactive material, 2. harm to people and the environment, and 3. the degradation of safety barriers. An event is first classified on each subordinate aspect of seriousness, and the highest of the three subordinate classifications is adopted as the event's overall classification. Classification of the release of radiation and harm to people and the environment is based on the actual consequences of the event: how much material was released into the environment or how many people were exposed to how much radiation. Classification of an event on the basis of the degradation of safety barriers does not require an incident or accident to have taken place: it is the removal of barriers that would otherwise prevent the occurrence of an incident that matters. The classification given to an event that involves the degradation of safety barriers depends on how many barriers remained undegraded and on the seriousness of any incident that had the potential to occur in the event of the undegraded barriers failing. Hence, not all events that are given INES classifications have any actual consequences for people or the environment.

INES levels 1 to 3 are defined as follows:

- Level 1 is an anomaly or a disturbance, such as if a facility's defined operating parameters are exceeded. Examples include the involuntary exposure of a member of the public to a radiation dose of more than 1 mSv per year inside (or 0.1 mSv per year outside) a facility where radioactive sources are used (the legal limit), the discovery or loss of a small radioactive source, or a minor technical disturbance in a nuclear power plant, which does not result in the escape of radioactive material beyond the facility.
- Level 2 is an incident. An incident is an event that results in degradation of the level of safety. Examples include the exposure of a radiological worker to more than 20 mSv per year (the legal limit), the loss or discovery of a large radioactive source, the involuntary exposure of a member of the public to more than 10 mSv, or a major leak in the primary system of a nuclear power plant.
- Level 3 is a serious incident. A serious incident is an event that results in further degradation of the level of safety, without causing an accident. Examples

include the excessive exposure to radiation resulting in (permanent or temporary) physical harm, ten or more people receiving a level 2-dose (see under level 2), the loss or discovery of a very large radioactive source, the exposure of a radiological worker to more than 200 mSv and the occurrence of radiation levels in excess of 1 Sv/h in an operational area.

The other INES levels are outside the scope of this report, no event where the seriousness exceeded level 3 occurred in the Netherlands in 2014 or any previous year.

Countries that participate in the INES regime (of which there are more than seventy) are obliged to report events of INES level 2 and above to the IAEA. INES classifications apply not only to events at nuclear facilities, but also to other events, such as excessive exposure to radiation, transportation events, events with radioactive sources and equipment, accelerators and (since the beginning of 2007 on an experimental basis), medical events. Non-civil events and nuclear terrorism are outside of the INES regime.

The accident that prompted the introduction of annual event reporting to the Dutch House of Representatives took place at the Three Mile Island II Nuclear Power Plant near Harrisburg in the USA on 28 March 1979 and was classified as INES level 5. The accident at Fukushima, Japan, on 11 March 2011 is the second accident to have been classified as INES level 7, the first being that at the nuclear power plant in Chernobyl in Ukraine on 26 April 1986. The Fukushima accident was initially assessed as INES level 5 on 18 March 2011, but on 12 April 2011 the classification was changed to INES level 7. The later classification reflects the estimated releases of radioactivity involved. The event's classification remains 'provisional', because there is still uncertainty regarding the exact amount of radioactive material that escaped.

On the basis of recent experience with application of the INES to the nuclear accident at Fukushima, the IAEA has investigated whether the INES should be revised. Its conclusion was that the scale did not require revision, but that a more cautious approach should be taken to the use of provisional classifications. A classification cannot be made until an event has entered a stable phase and a reliable picture of the final consequences is available. Although member states are expected to make INES reports within twenty-four hours, the twenty-four hour period starts when a reliable and stable picture becomes available, not when the event begins.

More information about the INES is available from the website of the IAEA.
A general leaflet is available at:
https://www.iaea.org/sites/default/files/ines.pdf
The user's manual, which describes the classification system in detail, is available at:
http://www-pub.iaea.org/MTCD/Publications/PDF/INES2013web.pdf