



Authority for Nuclear Safety and
Radiation Protection

Report on events in Dutch nuclear facilities during 2015

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Executive summary

Number of events

In 2015, nineteen events covered by the compulsory reporting requirements occurred at Dutch nuclear¹ facilities. The number of events in 2015 did not differ from the annual average of the last five years, that is, twenty.

Three events occurred at the Borssele Nuclear Power Plant (KCB) and sixteen occurred at other Dutch nuclear facilities. Of the latter, seven occurred at the Nuclear Research and Consultancy Group (NRG) High Flux Reactor (HFR), seven at NRGs other installations and two at URENCO.

Two events occurred during the transport of radioactive materials on the site of NRGs nuclear facilities. An event also occurred at the KCB in which an external employee from a research company was exposed to an unplanned radiation dose. Because these three events occurred on Dutch nuclear facility sites, they have been included in this report even though the licensee of the facility was not responsible for the occurrence of the events.

INES rating and severity

Nuclear safety was not compromised during any of the events which occurred in 2015. The events reported in 2015 were, furthermore, less serious²³ than the annual average of the last five years.

Two events have been rated by ANVS at level 1 of the internationally recognised INES scale: an anomaly with no safety significance⁴. The other seventeen events have been rated at INES level 0: a deviation with no safety significance.

KCB (nuclear power plant)

Few events occurred at the KCB in 2015, as was the case in previous years. A single event was rated at INES level 1. ANVS has established that the licensee of the Electricity Production Company South-Netherlands nuclear power plant (EPZ) is systematically focusing on reducing the

number of events. EPZ has made investments with the intention of improving the functioning of the facility and has improved its internal information and work processes. The number of reported events and the severity of these events in recent years are in line with these improvement measures.

NRG (research reactor and nuclear facilities)

The number of reported events at the facilities managed by NRG in Petten (fourteen in all) is the same as in the year before.

The severity of the reported events at these facilities in 2015 is also similar to the severity of those which occurred in 2014. 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.

URENCO

At URENCO, two events occurred in 2015, one of which resulted in a small amount of uranium ending up on the roof of one of the production halls. This event attracted a certain amount of publicity and parliamentary questions were asked about it. An investigation was carried out by the National Institute for Public Health and the Environment (RIVM) on the extent of the emission and any health consequences that might have arisen. RIVM concluded that no radioactivity had dispersed outside the site boundary during the event and that the event had not harmed the health of employees or local residents.

The event in which uranium ended up on the roof was rated at INES level 1. The other event was rated at INES level 0.

Other nuclear facilities

No events occurred at other Dutch nuclear facilities in 2015. This is in line with the situation in recent years.

Table 1 summarises all the events which occurred in 2015.

Conclusions

On the basis of the available information, ANVS concludes that the licensees of the nuclear facilities responded to the events which occurred at their facilities in 2015 with due care. In general, the licensees informed ANVS of these events within the agreed time limit. The causes of most of the events have now been determined and, in these cases, measures have been taken to prevent any recurrence in the future.

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 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 In this report, the severity of events is expressed as the number of events with an INES level of 1 or higher relative to the total number of events. For 2015, the ratio was 0.1 and for the last five years together, 0.2.

³ The final rating of the severity of a small number of events has not yet been determined because more detailed investigation is ongoing. The final ratings of these events are not expected to differ fundamentally from their provisional ratings.

⁴ For further information regarding INES, see the annex.

EPZ and NRG have been called to account by ANVS with regard to the fact that some investigations took too long to complete.

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 KEW⁵ licences.

Facility	Total number of events requiring a reporting	INES level 0	INES level 1	INES level 2
Borssele NPP	3	2 ⁶	1	-
High-Flux Reactor, Petten	7	7	-	-
Other NRG facilities, Petten	7	7 ⁷	-	-
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	2	1	1	-
Total nuclear facilities	19	17	2	-
PM Transport events	2	2	-	-
PM Radiation protection event	1	1	-	-

Table 1: The total number of events subject to a reporting requirement in 2015 at each company, categorised according to INES level.

⁵ KEW: Kernenergiewet. Dutch license for nuclear facilities.

⁶ Both ratings are provisional.

⁷ Five ratings are provisional.

1 Introduction

This report summarises the events which occurred at Dutch nuclear facilities in 2015. 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 is the second yearly report of ANVS. Next year, the report on events will be incorporated in an ANVS report with a broader context.

This report documents events which are related to a disruption in the safe 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.

Under the KEW licence, events must always be reported to ANVS. Separate notification requirements apply depending on the severity of the event. Serious events must be reported quickly, often within eight hours. Different time limits, such as 'within four weeks', apply for less serious events. Other events, such as slight contamination of surfaces or equipment and technical defects and organisational deviations without immediate consequences for the operation of the facility or nuclear safety, must be described in, for example, quarterly, six-monthly or annual reports. 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.

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, but they are all handled in the same way. 'Minor' events may be symptomatic of an underlying problem and the simultaneous occurrence of several minor events may have larger consequences which is why events have to be recorded and analysed accurately and immediately. 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.

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.

The events described in this report have been reported to ANVS by the licensees concerned. ANVS has checked the correctness of the notifications and whether they were made within the relevant time limits by means of inspections and desk analyses.

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 placed on ANVS's website as soon as it becomes available⁸.

This report includes the notifications made under the KEW by the following licensees⁹:

- the Electricity Production Company South-Netherlands (EPZ) in Borssele 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 Reactor¹⁰ (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;

⁸ See <http://www.autoriteitnvs.nl/onderwerpen/ongewone-gebeurtenissen>.

⁹ The licensees named can be divided into two categories: licensees under KEW 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).

¹⁰ Operations at the LFR were stopped at the end of 2010. The licence for the decommissioning of the reactor was issued on 18 December 2014. The decommissioning was started in 2015.

- the Dutch Energy Research Centre 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.

In addition, two events have occurred this year (at NRG's site) which had nothing to do with the nuclear facilities themselves but with the transport of radioactive material from them. These events have been included in a separate section of this report on transport. An event in the field of radiation protection has also been included in this report.

2 Events in the Netherlands in 2015

This chapter summarises the events which occurred at Dutch nuclear facilities in 2015.

2.1 Borssele Nuclear Power Plant (KCB), Borsele

Three events, which were reported to ANVS, occurred at facilities managed by EPZ, the licensee of the KCB in 2015.

13 May 2015: The nuclear power plant was shut down because of technical defects in the emergency power system; INES level 1

On 13 May 2015, EPZ reported that it had ascertained during regular tests of the emergency power system that various individual emergency power batteries did not meet the capacity requirements. The nuclear power plant was shut down because this official requirement was not met. As a result, EPZ started the annual planned maintenance of the plant earlier than scheduled. EPZ has shown that all of the emergency power batteries always met the minimum capacity stipulated by the KEW licence during operation of the plant and that the event did not constitute an unsafe situation.

The emergency power batteries provide power for the nuclear power plant's controls and safety devices, so that it can safely be taken out of operation in the highly unlikely case that the nuclear power plant's other power sources become unfit for use (as a result of a natural disaster, for example).

The emergency power batteries in question have been replaced. EPZ has demonstrated to ANVS that the new batteries will meet capacity requirements throughout the reactor's upcoming period of operation (one year). After ANVS had given its approval, the nuclear power plant was restarted on 11 June 2015. EPZ has investigated the matter of why individual batteries aged more rapidly than was to be expected on the basis of the manufacturer's warranties. This investigation has demonstrated that the batteries showed technical defects. Moreover, EPZ has determined that part of the reason the batteries failed to achieve their planned twenty year lifetime was due to the way they were charged.

ANVS supervised the investigation and assessed the result and the measures proposed by EPZ as adequate.

EPZ has now revised both the selection policy for new batteries and the battery-charging process.

ANVS has rated this event at INES level 1: an anomaly, because of the fact that the emergency power provided by the batteries was not fully available during operation and because there was insufficient monitoring of quality in the selection and procurement of the batteries.

ANVS has registered this event in the International Atomic Energy Agency (IAEA) database (because many reactors use this type of battery) which publishes details of events in nuclear power plants¹¹. This enables other countries to carry out investigations into similar situations at their own nuclear power plants.

20 May 2015: Period of less than optimum cooling longer than expected; INES level 0 (provisional rating)

On 20 May 2015, EPZ reported that complications had arisen at the KCB (which, at the time, was out of operation due to annual maintenance) during the hoisting of the lid of the reactor pressure vessel (RPV). When it was hoisted, the pulley block of the hoisting crane became skewed, as a result of which cables rubbed against the block. As a result, the decision was taken to replace the lid. The hoisting activities were resumed following modification and re-inspection of the hoisting installation by an independent inspection body. Hoisting took place under the strict supervision of the supplier and the inspection body and no irregularities were found. The consequence of this delay was that, while the fuel was being changed, the reactor spent approximately twelve hours longer 'in mid-loop' than was originally planned. 'Mid-loop' is an operating mode in which the fuel is in the RPV and is cooled in a normal manner but in which there is temporarily less water available in the cooling system for this cooling process. In this operating mode, less time is available to correct things in the event of a failure of the cooling system, so it is kept as short as possible. The longer than planned duration of this operating mode was, therefore, reported to ANVS as an event.

EPZ has now determined that mistakes were made during the reconditioning of the pulley block by the supplier. Hoisting tests prior to the maintenance stop did not reveal this defect. EPZ is still trying to trace the basic causes of the crane defect and will take measures to prevent any recurrence. ANVS is supervising the investigation and will assess the result and the proposed measures.

On the basis of the information available so far, ANVS has provisionally rated this event at INES level 0: no safety significance, because it is assumed that an unsafe situation did not occur. The event will be assigned a final rating after assessment of the results of the more detailed investigation.

¹¹ See <http://www-ns.iaea.org/downloads/ni/irs/iaea-nei-irs2008.pdf>.

28 May 2015: Incorrect calibration of the standby emergency cooling water system; INES level 0 (provisional rating)

On 28 May 2015, EPZ reported that, on 27 May 2015, the flow meter of the standby emergency cooling system of the KCB was calibrated at a time which is not permitted. This flow meter may only be calibrated if the reactor has been shut down and the fuel is in the opened RPV. In this case, however, the calibration was carried out while the fuel was in the fuel storage basin. The requirement laid down on this point in the plant's Technical Specifications (TS) was therefore not met. The standby emergency cooling water system is intended to draw cooling water from the groundwater under the company site if, in an emergency, no cooling water is available from the Westerschelde. In such a case, the flow meter measures the amount of emergency cooling water delivered.

EPZ is investigating the underlying cause of this deviation from the TS. The investigation had not yet been completed at time of publication. ANVS is supervising the investigation and will specifically verify whether the investigation focuses on the fact that, during the period under review, several calibrations were carried out at times which are not permitted. For details, see the report submitted on 17 November 2014.

On the basis of the information available so far, ANVS has provisionally rated this event at INES level 0: no safety significance, because an unsafe situation did not occur as sufficient alternative cooling systems were available throughout the event and the situation in question only existed for an extremely short time. The event will be assigned a final rating after assessment of the results of the more detailed investigation. The rating of the event may be raised to INES level 1 if more detailed investigation shows that the event has a repetitive character, in which case, too few lessons will have been learned from the previous occurrences.

2.2 Other Dutch nuclear facilities

2.2.1 NRG High-Flux Reactor (HFR), Petten

Seven events, which were reported to ANVS, occurred at the HFR in 2015.

5 February 2015: Leakage of tritiated water into the soil as a result of a filling hose snapping off; INES level 0

On 5 February 2015, NRG reported that, on 3 February 2015, an estimated 1 to 3 cubic metres of tritiated water leaked into the soil at the HFR site. The soil on the HFR site was being remediated after the discovery, in 2012, that tritiated water had leaked into the soil due to a leaky underground pipe. Tritium is a low-level radioactive material. The leakage which occurred on 3 February 2015 was caused by the snapping off of a filling hose which had been used for

pumping water from an interim storage tank to a road tanker during the soil remediation. During the remediation process, contaminated groundwater was transported by road tanker to the DWT, the NRG facility for decontamination and recycling, for processing.

The activity of the leaked water was 24.3 MBq per cubic metre. For reference: the standard above which remediation is statutory for the HFR site is between 0.1 and 7.4 MBq per cubic metre, depending on the location on the site.

NRG has investigated the cause of the filling hose snapping off and taken measures to prevent any recurrence in the future. NRG has, furthermore, improved the construction for filling and emptying the tanks. The leakage has no effect on the ongoing remediation activities on the HFR site.

ANVS has rated this event at INES level 0: no safety significance, because the effect of the event is minor.

The ongoing remediation process will reduce the amount of tritium in the soil at the company site significantly.

10 February 2015: The alarm level of the monitoring of radioactivity in the reactor hall was set too high; INES level 0

On 10 February 2015, NRG reported that, during a check, an HFR operator had discovered that the setting of the system which monitors the concentration of radioactive materials in the air of the reactor hall was too high. This monitoring system is part of the reactor safety system. The setting which was too high applies to both the value at which a warning alarm is supposed to go off and the value at which the reactor must automatically shut down. The values set were almost 40% higher than the permitted values stipulated in the Safety Specifications. These deviations were discovered during the fuel change stop. NRG corrected the deviations and checked the settings of the other components of the reactor safety system before the reactor was started up again.

If an incident in which radioactive materials had been released into the reactor hall had occurred in the period in which the settings were too high, this would not have led to an emission to the environment because the reactor hall functions as an airtight casing. NRG has investigated the cause of this deviation. On the basis of this investigation, NRG has improved the calibration procedures. ANVS has rated this event at INES level 0: no safety significance, because the HFR has various provisions for the prompt identification of disruptions in the production process and there was no risk of the spread of radioactive materials outside the facility at any time.

27 March 2015: Outage of external power supply; INES level 0

On 27 March 2015, NRG reported that, because of an outage of the mains power in North Holland, an emergency power situation arose at the site of the Petten Research Centre, where NRG operates both the HFR and a number of other nuclear facilities such as the HCL and the Waste Storage

Facility (WSF). As a result of the mains power outage, NRG put the internal emergency plan into operation. This plan ensures that, in the case of an emergency, safe and careful responses are made to unexpected circumstances. As a precaution, the HFR was shut down and diesel generators were used to provide emergency power. In the course of the afternoon, the normal power supply was restored, after which NRG returned all of the facilities to normal operation in a controlled manner. Although the cause of this event was outside NRG's control, the company was still obliged to report it because the internal emergency plan went into operation. ANVS kept abreast of developments at Petten throughout the day and assessed the evaluation carried out by NRG in response to the event. This event will be incorporated in the restructuring of the company emergency organisation, which is currently ongoing.

ANVS has rated this event at INES level 0: no safety significance, because the facilities were shut down in a controlled manner, the safety systems functioned properly and the emergency organisation went into operation.

7 July 2015: Defect in the shutdown system of the reactor; INES level 0

On 7 July 2015, NRG reported that investigation had shown that two of the HFR's six control rods had a longer drop time than is permitted. During normal operation, control rods are only partially lowered into the reactor, if at all. The drop time is the time within which they drop fully into the reactor (after a drop signal is given).

The control rods stop the nuclear fission process in the reactor. They drop if a malfunction occurs in the process. A maximum drop time is stipulated in the Safety Specifications.

NRG discovered that the malfunction was caused by a defective switch (relay) in the shutdown system. After the notification, ANVS actively consulted with NRG. ANVS asked NRG for a substantiation of the reliability of the entire shutdown system, before the HFR could be started up again, which NRG subsequently submitted. NRG replaced the relay in question and took additional measures to detect this type of defect more quickly in the future. ANVS subsequently notified NRG that the restriction had been lifted and the HFR could be started up again.

ANVS has rated this event at INES level 0: no safety significance, because no unsafe situation occurred as the drop time of the control rods has generous safety margins and because the HFR could also be shut down safely with the other four control rods (which did drop within the given time limit).

16 September 2015: Deviation in a control rod; INES level 0

On 16 September 2015, NRG reported that the 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. This can indicate an irregularity in the operations or a defect in the facility. The continual monitoring of reactivity in the reactor is one of the measures taken to guarantee safety.

The safety margins for this type of measuring signal are large. Nuclear safety was not compromised. NRG carried out an investigation to determine the cause of the increased noise. This revealed defects in one of the six control rods that regulate 'power' in the reactor. In 2013, an event occurred which also involved a deviation in the control rods¹².

At the time, NRG took measures to prevent any new deviations. All control rods, including the control rod which now showed a deviation, were extensively tested and inspected again. Since then, the process for assembling new control rods has been improved. The supervision of assembly and quality control have been intensified. The investigation has determined why, despite these additional quality measures, this defect could still occur. The control rod which caused the 'noise' originated from 'old stock', which had been assembled using the old procedures. Apparently the additional testing and new inspection had not been able to detect the defect.

NRG subsequently decided to reject all control rods from the 'old stock' and only to use control rods put together in accordance with the new assembly process. NRG will carry out additional research to see whether the manufacture of new control rods (and the 'guiding' of the control rods during use) can be further improved to reduce the risk of this type of defect still further.

ANVS has concluded that the investigation was carried out properly and that the proposed measures are adequate to guarantee that the HFR can be started up safely again.

ANVS has rated the event at INES level 0. Reactor safety was not compromised because the reactor safety system has sufficient safety margins. Furthermore, no other factors were involved which would have justified a higher rating. In this case, NRG reacted extremely promptly by shutting down the reactor, as a preventive measure, when there was the slight suspicion of a process disruption.

¹² For details, see the notification on the ANVS website dated 26 September 2013.

24 October 2015: Malfunction in the system for measuring the activity of secondary cooling water; INES level 0

On 24 October 2015, NRG reported that, during maintenance activities carried out earlier in the day, for a few hours there was no monitoring of the activity of the secondary cooling water of the HFR at Petten. Secondary cooling water is the water which is pumped out of the Noord-Hollands canal and which cools the cooling water of the reactor via a heat exchanger. After passing the heat exchanger, the secondary cooling water is discharged into the North Sea.

The secondary cooling water does not come into direct contact with the reactor or with the primary cooling water, so it is not radioactive. The activity of the secondary cooling water is monitored to exclude the possibility of any contamination, for example through leakage from the heat exchanger.

As soon as the company discovered that the monitoring system was out of operation, it was restarted and ANVS was notified. NRG has investigated the cause of this deviation. It appeared that the monitoring equipment had been unintentionally switched off. Because of this event, operating instructions are being drawn up to enable maintenance activities to be carried out without any such malfunctions in the future.

ANVS has verified the investigation and found that it was carried out correctly.

ANVS rated this notification at INES level 0: no safety significance, because the event was noticed and remedied quickly and it was determined afterwards that no leakage or contamination had occurred while the monitoring system was out of action.

29 October 2015: Outage of a part of the external power supply; INES level 0

On 29 October 2015, NRG reported that, due to a regional power outage, the northern part of the Petten site temporarily had no mains power supply on the evening of 28 October 2015. The HFR was the only one of the NRG facilities that were affected. The emergency power systems (diesel generators) automatically went into action and no safety or security systems were out of operation. As the reactor was not operational at the time, it did not have to be shut down.

When the power outage occurred, NRG decided to initiate the internal emergency plan. The emergency organisation convened but did not have to take any action.

Although the cause of the power outage was outside NRG's control, it still had to be reported because there is a notification obligation for any event in which the internal emergency plan is initiated.

ANVS has rated this at INES level 0: no safety significance, because the emergency power systems functioned and the emergency organisation went into action. Nuclear safety was not compromised.

2.2.2 Other NRG facilities¹³, Petten

In 2015, seven events, which were reported to ANVS, occurred at NRG's other facilities.

24 and 26 March 2015: HCL - Malfunction in the radiological monitoring system; INES level 0 (provisional rating)

On 31 March 2015, NRG reported that, on Tuesday 24 March 2015 (during the day) and Thursday 26 March 2015 (during the night), a malfunction occurred in the radiological monitoring system which monitors any radioactive materials that may be released from the cells of the HCL in the event of an incident. The event was caused by a defective relay in the HCL's power supply. On discovering these malfunctions, NRG evacuated the HCL as a preventive measure (on 24 March 2015) and banned the employees from entering (on 26 March 2015).

Because cell ventilation was functioning normally at the time of the events, any radioactivity which might have been released would not have been able to escape without being filtered. There was therefore no question of any emissions to the outside air. The defective relay was replaced. In the light of this event, the part of the facility in question was thoroughly inspected. On the basis of the findings of this investigation, NRG will, if necessary, take additional measures. ANVS is supervising the investigation and will assess the result and the proposed measures.

On the basis of the information available so far, ANVS has provisionally rated this event at INES level 0: no safety significance, because the correct measures (including evacuation) were taken and there was at no time any risk of the spread of any radioactive materials outside the facility.

4 May 2016¹⁴: HCL – Underpressure and evacuation alarms went off but procedure was not followed; INES level 0 (provisional rating)

On 4 May 2016, NRG reported that, on 23 July 2015, the underpressure alarm in one of the hot cells went off during the transport of materials into and out of the cell. The hot cells, in which radioactive materials are processed, must be kept at a lower pressure than the surrounding rooms to prevent the spread of radioactive materials.

¹³ '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).

¹⁴ In the first instance, NRG did not report this event because it was of the opinion that the event was not subject to a notification requirement. However, during an ANVS inspection carried out in early 2016, it was determined that the event was, on the contrary, subject to a notification requirement. NRG subsequently reported the event.

The underpressure alarm was automatically followed by an evacuation alarm. Employees did not respond to the alarm signal as stipulated in the procedure. The alarm was switched off and work was resumed without first checking for the presence of radioactive materials outside the dedicated rooms. On the basis of check measurements taken afterwards, NRG concluded that this event had no actual consequences for the employees.

NRG is investigating how this incident could have taken place and will take measures to prevent any recurrence in the future. The investigation will also look at the increase in the number of underpressure alarms detected.

ANVS is supervising the investigation and will assess the result and the proposed measures. ANVS will also check why the event was not reported promptly. On the basis of the information available so far, ANVS has provisionally rated this event at INES level 0: no safety significance, because no radioactivity was released and there was at no time any risk of the spread of any radioactive materials outside the facility. The event will be assigned a final rating after assessment of the results of the more detailed investigation. The rating of the event may be raised to INES level 1 if more detailed investigation shows that the event has a repetitive character, in which case, too few lessons will have been learned from the previous occurrences.

8 July 2015: General - Failure of a part of the fire hydrant system; INES level 0

On Wednesday 8 July 2015, NRG reported leaks during repairs to the fire hydrant system, after which part of the fire hydrant system was shut down. As a result, various facilities, including the DWT (this is the NRG facility for decontamination and recycling) and another company located on the site had no extinguishing water. Compensating measures were taken immediately. Alternative extinguishing water provisions were laid on from another extinguishing water connection point outside the affected sector and it was agreed that the procedure would be revised so that, in the event of a fire, action would be taken at an earlier stage to 'scale up' to the regional fire brigade.

The extinguishing water system was repaired on Friday 10 July 2015 after which the temporary measures were discontinued. ANVS kept abreast of developments at Petten throughout the period of reduced availability of the fire hydrant system. NRG has investigated the situation to ascertain how the leaks arose and has taken measures to prevent any such leaks in the future. ANVS has rated this event at INES level 0: no safety significance because no unsafe situation occurred as compensatory measures were taken immediately.

28 September 2015: MPF – Evacuation as a result of the underpressure alarm; INES level 0 (provisional rating)

On 28 September 2015, NRG reported that, on 14 September 2015, the MPF was temporarily evacuated because of an alarm signal.

The alarm signal indicated that the required permanent underpressure had fallen off in one of the MPF production cells. The underpressure prevents radioactive materials from escaping into rooms in which employees are present or to the outside air. Evacuation of the MPF is prescribed procedure in such situations.

The evacuation was lifted after NRG had ascertained that conditions were safe for the employees to resume work.

NRG ascertained no contamination or emissions to the outside air, so that the safety of the employees and environment were not compromised.

NRG is investigating the cause of the fall-off of the underpressure. ANVS is supervising the investigation and will assess whether the event was reported promptly and its severity correctly estimated. The result of the investigation and the proposed measures will be assessed.

On the basis of the information available so far, ANVS has provisionally rated this event at INES level 0: no safety significance, because there were still sufficient safety barriers in place. It will only be possible for a final rating to be assigned when the results of the investigation by NRG are known.

6 October 2015: MPF – Storage tanks were not emptied promptly as a result of a line not having been fully closed; INES level 0 (provisional rating)

On 6 September 2015, NRG reported that, on 21 September 2015, a deviation was ascertained in the MPF's production process. Investigation showed that two tanks used for the interim storage of radioactive waste from the molybdenum production process were full whereas employees had assumed that they still had sufficient capacity. The tanks had filled up again as a result of a 'siphon effect' because a transport line was not fully closed. NRG is investigating how this incident could have taken place and is taking measures to prevent any recurrence in the future.

ANVS is supervising the investigation and will assess whether the event was reported promptly and its severity correctly estimated. The result of the investigation and the proposed measures will be assessed. On the basis of 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, safety was not compromised. It will only be possible for a final rating to be assigned when the results of the investigation by NRG are known.

15 October 2015: General – Contamination of an employee and the workplace by leakage from a waste container; INES level 0

On 15 October 2015, NRG reported that, on 2 October 2015, it had ascertained that contamination had occurred during the transfer of containers containing radioactive waste from one building to another. It appears that there was a leak in one of the containers. As a result of the leak, radioactive material was deposited at various points on the floor in one of these buildings. An employee's hand and shoe were contaminated.

The local emergency organisation was called out and the area was cordoned off. Once all traces of the contamination had been cleaned from the employee, NRG carried out measurements to identify any contamination on the site and in the building. NRG removed all traces of the contamination it detected.

NRG has investigated the causes of this event and has taken measures to prevent any recurrence in the future. ANVS has rated this event at INES level 0: no safety significance, given the limited nature of the contamination.

21 December 2015: HCL - The under-pressure alarm going off led to the temporary evacuation of the laboratory; INES level 0 (provisional rating)

On 21 December 2015, NRG reported that, on 10 December 2015, the underpressure alarm going off in the HCL led to the temporary evacuation of the laboratory. The hot cells are kept at a lower pressure than the surrounding rooms to prevent any release of the radioactive materials they contain. When material was being transferred to a transport container, the port to which the container was connected was not properly sealed, as a result of which air was able to escape from the transport hall to the cell, causing a drop in the underpressure. On hearing the underpressure alarm, the operator immediately closed the port and the HCL was evacuated. After the evacuation, employees entered the HCL with respiratory protection and took measurements to locate any contamination. These measurements showed that neither the port nor the area in the immediate vicinity of the port had been contaminated.

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. On the basis of the information available so far, ANVS has provisionally rated this event at INES level 0: no safety significance, because there were still sufficient safety barriers in place. It will only be possible for a final rating to be assigned when the results of the investigation by NRG are known.

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

No events which were subject to a reporting requirement occurred at COVRA in 2015.

2.2.4 Higher Education Reactor (HOR), Delft

No events which were subject to a reporting requirement occurred at HOR in 2015.

2.2.5 Dutch Energy Research Centre (ECN), Petten

No events which were subject to a reporting requirement occurred at ECN in 2015.

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

No events which were subject to a reporting requirement occurred at GCO in 2015.

2.2.7 Joint Nuclear Power Plant Nederland (GKN), Dodewaard

No events which were subject to a reporting requirement occurred at GKN in 2015. GKN was definitively shut down on 26 March 1997.

2.2.8 URENCO Nederland, Almelo

Two events, which were reported to ANVS, occurred at URENCO in 2015.

19 March 2015: A cylinder was overfilled with uranium hexafluoride; INES level 0

On 19 March 2015, URENCO reported that, while a cylinder of uranium hexafluoride (UF₆) was being weighed, it was ascertained that the cylinder had been filled with more UF₆ than is permitted. The cylinder in question was overfilled as a result of a deviation in the filling system's weighing instrument. This was discovered during the standard weight check which is always carried out after filling, using a second (independent) weighing instrument. Such events must be reported to ANVS within thirty days. This event occurred on 27 February 2015, so URENCO reported it within the prescribed time limit.

After ascertaining the overfilling of the cylinder with UF₆, URENCO transferred the excess UF₆ to another cylinder under controlled conditions.

URENCO has investigated the underlying cause of this event and taken measures to prevent any recurrence.

ANVS has assessed the results of the investigation and has approved the proposed measures. ANVS has rated this event at INES level 0: no safety significance, because the system of double measurements ensures that a cylinder cannot leave the building if it has been overfilled.

27 August 2015: Filter material released in the production hall of the enrichment facility; INES level 1

On 27 August 2015, URENCO reported that an event had occurred in the enrichment facility that morning. The event occurred in a filter system in a room in which enriched uranium is collected. There was no one present in the room in question at the time. As a precautionary measure, some rooms were evacuated after the event and production in the hall in which the event occurred was stopped. Production in the adjoining hall was also shut down because it is directly connected with the hall in which the event occurred. As a result of the event, uranium-containing material from the filter facility ended up in the production hall and some adjoining rooms. An elevated concentration of low-level radioactive material was detected in the ventilation system leading to the roof of the production hall. Very small amounts of uranium were also found on the roof of the hall. On the basis of measurements, URENCO excluded the possibility that uranium had spread to the surrounding area. URENCO cleaned the premises and investigated the cause of the event. In response to the event, URENCO took measures to enable resumption of production in the other production halls fairly rapidly after the event. ANVS carried out regular on-site inspections.

Investigation into possible spread and effects in the surrounding area

At the request of ANVS, RIVM checked the correctness of the measurements carried out by URENCO during the event. ANVS supervised the investigation. RIVM's report was submitted to ANVS at the beginning of 2016 and was subsequently published¹⁵. RIVM confirmed that it was not likely that the contamination had dispersed outside the URENCO site. This means that there was no risk to the health of local residents. The estimates of the amount of uranium on the roof varied from a minimum of 0.4 g uranium to a maximum of 40 g, with 6 g as the most probable value. If, in the worst case-scenario, the maximum estimate of 40 g had indeed been released, this would have been 1.5 percent of the licensed annual limit. In reality, the amount released will have been less. The wind carried the emission in the same direction as the roof's long axis. The radioactivity was dust-bound, and it precipitated on the roof. This contamination was removed by URENCO on the same day. ANVS has adopted the findings and conclusions of RIVM.

Investigation into the technical cause and measures

URENCO has investigated the technical cause of the event and replaced all similar filters by a different type, so the phenomenon in question cannot recur. The adjoining hall was cleaned and, after an assessment of the substantiation of the investigation into the technical cause and an inspection of the radiological clearance of the hall in question and the start-up programme, ANVS issued a certificate of no objection for the resumption of production in this adjoining hall on 23 October 2015. The certificate was issued on condition that URENCO carry out an additional investigation into possible underlying causes of the event and reassess the qualification of the new type of filter critically in the light of knowledge acquired as a result of the event. URENCO has now revised the qualification of the new type of filter. The additional investigation into the underlying causes of the event requested by ANVS was submitted to ANVS on 3 March 2016. ANVS will verify this report and ensure that URENCO learns from the event to prevent the recurrence of any such events. The cleaning operations in the hall in which the incident occurred have now been completed. ANVS supervised the radiation protection of the employees involved in the cleaning by means of inspections. ANVS has now issued a certificate of no objection, on the basis of which URENCO resumed production in all the halls in question on 25 March 2016.

Rating of the severity of the event and the follow-up

On the basis of RIVM's findings, ANVS has rated the event at INES level 1, an anomaly, because, although the radiological consequences of the release of a small amount of uranium in the hall and on the roof were very slight, a safety barrier was nevertheless breached.

2.2.9 Transport of radioactive materials

This section describes two events which occurred on the site of a nuclear facility but to which the KEW licence for the facility does not apply.

26 January 2015: Incomplete listing of radionuclides in transported radioactive materials; INES level 0

On 26 January 2015, NRG reported that questions had been asked about the composition of radioactively contaminated resin in waste material transported to a processing company in Britain. NRG uses resin to collect radioactive materials from the cooling water of the HFR. These radioactive materials accumulate in the resin, which is subsequently transported to Britain for processing. On arrival in Britain, it became apparent that certain radioactive materials, which were not listed on the transport documents, were present in the resin. The resins had been packaged in accordance with the regulations and the substances which were not listed on the documents were not detectable on the outside of the transport container. The incomplete list therefore had no effect on safety during transport.

¹⁵ See http://www.rivm.nl/Documenten_en_publicaties/Wetenschappelijk/Rapporten/2016/februari/Onderzoek_bij_Urenco_naar_emissies_na_incident_met_koolfilter_op_27_augustus_2015.

NRG has investigated the cause of this incomplete listing and the possible consequences for future transports and has taken measures to prevent any recurrence in the future. The resins transported were taken back and, on the basis of what has been learned about them, NRG is investigating the best possible destination for this material. ANVS is supervising the investigation and will assess the method of disposal. ANVS has rated this event at INES level 0: no safety significance, because there was at no time any danger to employees or the environment.

19 January 2015: Excessive activity in a transport container; INES level 0

On 19 January 2015, NRG reported that a transport container of radioactive material it had dispatched contained more activity than was permitted under the regulations. The dispatch comprised three containers containing Yttrium-90, an isotope used for medical applications. Yttrium-90 is an isotope which decays rapidly. The isotope's activity decreases by half in a few days, due to radioactive decay. The deviation was caused by the fact that the cooling time observed prior to dispatch was too short. This is the time in which the activity of the material decreases due to radioactive decay. NRG has taken measures to prevent any recurrence in the future. ANVS has rated this event at INES level 0: no safety significance, because this minor breach of the regulations had no consequences for employees or the environment.

2.2.10 Radiation protection

This section describes an event which occurred on the site of a nuclear facility, that is, the KCB, but to which the KEW licence for the facility does not apply.

30 May 2015: An employee from a company for non-destructive testing was unintentionally exposed to radiation from a source as a result of a technical defect; INES level 0

On 30 May 2015, the Social Affairs and Employment Inspectorate (Inspectorate SZW) and ANVS were informed of the fact that a radiation incident had occurred at the KCB on 29 May 2015. An external company had been investigating a welded joint using a radiation source. Because of an incorrect action, the radiation source was outside the lead casing for a short while, thus unintentionally exposing one of the company employees carrying out the investigation to an unexpected radiation dose.

The exposure was below the legal dose limit for employees and, because the amount of radiation was so small, there were no consequences for the health of the employee. The method of working with these radiation sources at the nuclear power plant has now been revised.

This event was rated at INES level 0: no safety significance, because the dose to which the employee was exposed was below the legal dose limit.

2.3 Dutch event reports to the IAEA in 2015

Events of INES level 2 and higher must be reported to the IAEA 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 2015.

The IAEA manages databases of events which have occurred at nuclear facilities¹⁶. 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 2015, a report was submitted by the Netherlands to the IAEA about an event which occurred at the KCB. The report concerned technical defects in the emergency power system. See the event which occurred on 13 May 2015.

¹⁶ The databases can be found here: <http://nucleus.iaea.org/Pages/default.aspx>. Most databases are not open to the public.

3 ANVS analysis of events in the Netherlands in 2015

Chapter 2 contains all the reported events which occurred at the various Dutch nuclear facilities in 2015. 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 which have occurred in the last ten years, from 2006 up to and including 2015. The information has been broken down into events which have occurred at the KCB and those which have 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 shows this information in a graph.

Year	TOTAL			INES > 0		
	Total	KCB	Other	Total	KCB	Other
2015	19	3	16	2 ¹⁷	1 ¹⁸	1 ¹⁹
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
2006	25	17	8	3	1	2

Table 2: The number of events subject to a reporting requirement which occurred at the KCB and other nuclear facilities from 2006 up to and including 2015.

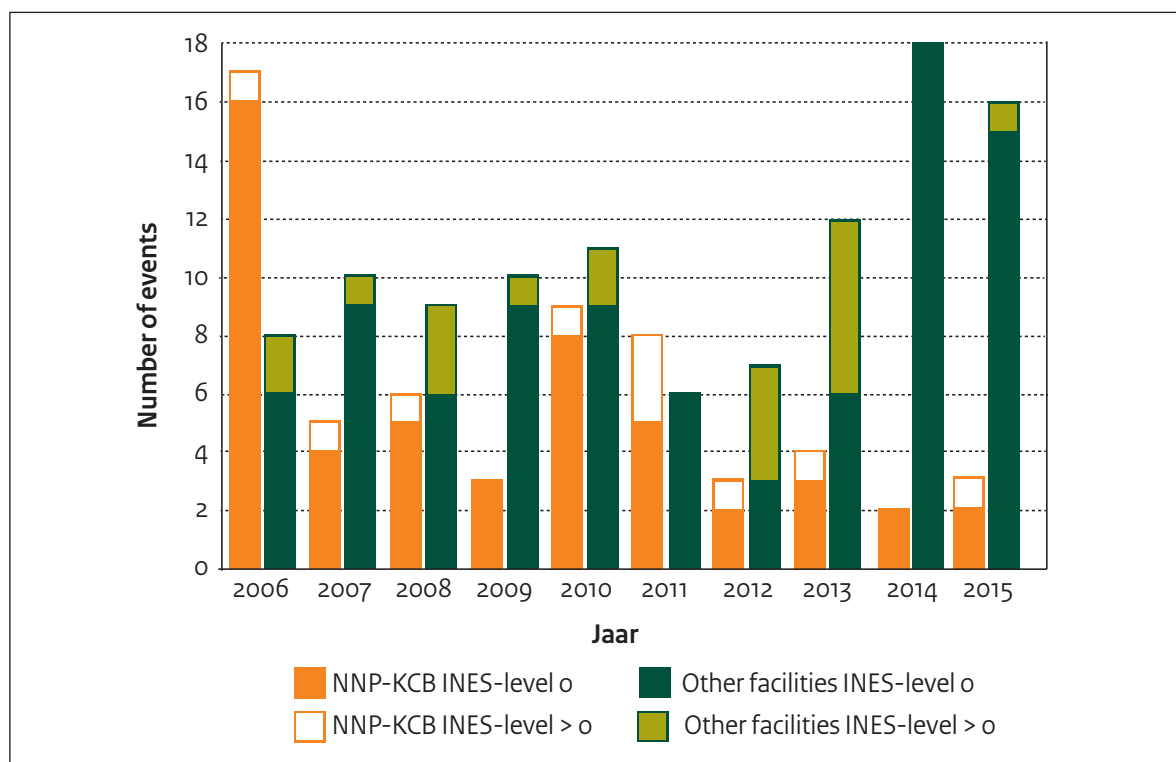


Figure 1: The number of events subject to a reporting requirement which occurred at the NPP-KCB and other nuclear facilities from 2006 up to and including 2015.

¹⁷ This number is provisional because seven events have yet to be assigned a final rating. It will only be possible to make a reliable estimate once the investigation into the cause has been completed. This may take longer than a year.

¹⁸ Ditto.

¹⁹ Ditto.

The first question of how serious these events were can be answered with the aid of the INES ratings assigned.

When the INES scale was set up in 1989, the criteria for rating events at the different levels were laid down such 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.

The severity of events at Dutch facilities in 2015 was low, according to the internationally used benchmark. The nineteen events which occurred in 2015 were, after all, characterised as 'less serious' (INES level 0 or INES level 1). Incidentally, some of the events have yet to be assigned a final rating. It will only be possible to assign final ratings once the investigations into their causes have been completed. Some complex investigations inevitably take longer than a year.

Whether the situation at the nuclear facilities in 2015 is better or worse than in previous years and whether they perform better or worse than those abroad is less easy to determine. The reasons are as follows:

- Statistics on the data are scarce. Too few events have occurred to be able to base an informed opinion on them.
- The INES scale may perhaps give a good understanding of the severity of a situation, but it does not judge whether, for example, two INES level 0 events are more or less serious than a single INES level 1 event.
- An event must be rated at a minimum of INES level 2 before the country concerned is obliged to enter it in the INES system. An objective numerical comparison of INES levels 0 and 1 with other countries is therefore not possible.
- The notification criteria always give room for 'interpretations'. This means that an increase in the number of notifications due to a greater willingness to report events could incorrectly be seen as a worsening of the situation.

Based on the severity of the reported events in 2015, we can conclude that, on average, this was lower than the annual average for the last five years. The severity of the events is expressed as the number of events with an INES level 1 or higher compared to the total number of events. For 2015, this ratio was 0.1 and jointly for the last five years, 0.2.

Taking this into account, the number of events which occurred at nuclear facilities in the Netherlands in 2015 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 2015, one of which was rated at INES level 1 and two (provisionally), at INES level 0. This is the fourth successive year that the number of events has decreased compared to previous years. In terms of their severity (the INES rating), the events did not differ from those in previous years.

On the basis of the available information, ANVS has concluded that EPZ tackled the events which occurred at the power plant in 2015 with due care. The events were reported within the prescribed time limit and are analysed in depth. Incidentally, some analyses are not proceeding as quickly as might be wished.

EPZ has been able to show that it has learned from the events which have occurred and that, where necessary, it is taking steps to prevent any recurrence.

ANVS is of the opinion that EPZ has learned sufficient lessons from the events which occurred in 2015, is actively carrying out more detailed investigation and has realised the necessary improvements. ANVS is staying abreast of the progress and effectiveness of the analyses and improvement programmes in question, while carrying out on-site inspections and, where necessary, applying enforcement instruments to promote compliance.

3.2 Other Dutch nuclear facilities

3.2.1 NRG

Under the notification requirements in its licence, NRG reported thirteen events to ANVS in 2015. During an ANVS inspection of the events which occurred in 2015, it was ascertained, at the beginning of 2016, that those involved had failed to notify ANVS of one event which should have been reported. NRG has subsequently reported the event in accordance with the correct procedures. The number of events reported (totalling fourteen) is slightly lower than in previous years. None of the events reported in 2015 were very serious. On the basis of the information available so far, all such notifications have been rated at INES level 0. Compared with the rest of the Dutch nuclear sector, NRG in Petten reports a relatively high number of events which are subject to a reporting requirement. This is explained by the fact that NRG is developing a wide diversity of nuclear activities at many unique facilities in Petten. ANVS deems the number and severity of the events reported by NRG to be explicable and acceptable.

There are signs that the safety awareness of the company is growing. This greater safety awareness manifests itself in the substantial increase in the number of internal reports of 'Potentially Unsafe Situations' during the last two years (POS). These are events, both in the nuclear and occupational health and safety sense, which are reported internally and after which measures are immediately taken;

a more detailed analysis of the underlying causes can be carried out depending on the nature and severity of the event. POSs are not usually subject to a notification requirement.

The capacity of NRG to analyse events is increasingly falling behind because of the rise in the number of notifications. The quality and promptness of the analysis of the events varies as a result. The HFR deals with events in a satisfactory manner. The situation at NRG's 'other facilities' must improve.

ANVS ascertains that NRG is firmly on course when it comes to analysing and learning from events. With the proposed measures, NRG expects to catch up with the backlog of analyses of the internal POSs within the foreseeable future. ANVS will closely monitor the situation.

3.2.2 Other nuclear facilities

Two events which were subject to a reporting requirement occurred at other nuclear facilities in 2015, both at URENCO. These events have been rated at INES levels 1 and 0. This is average for the 'other nuclear facilities' group compared to earlier years.

The event at URENCO, in which a small amount of uranium ended up on the roof of one of the production halls, is particularly worth mentioning. This event attracted a certain amount of publicity and parliamentary questions were asked about it. An investigation was carried out by the National Institute for Public Health and the Environment (RIVM) into the extent of the emission and any health consequences that might have arisen. RIVM concluded that no radioactivity had dispersed outside the site boundary during the event and that the event had not harmed the health of employees or local residents.

The event in which uranium ended up on the roof was rated at INES level 1.

Agreements were made with URENCO on a more detailed report on this topic. ANVS will monitor the completion of the activities relating to this event.

The other event was rated at INES level 0.

The two events (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 is of the opinion 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.

On the basis of the available information, ANVS concludes that, in general, the licensees of the nuclear facilities tackled the events which occurred at their facilities in 2015 with due care. Almost all the events were reported and properly analysed within the time limit specified in the licence. The causes of many events have now been determined. Investigations are still ongoing for a few of the events.

The licensees have all been able to show that they are making efforts to learn from the events which have occurred and that, where necessary, they are implementing measures to prevent any recurrence.

Annex

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. To this end, use is made of the IAEA's INES and the Organisation for Economic Cooperation and Development (OECD)'s Nuclear Energy Agency (NEA). 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 which protect 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 population 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'. Level 2 incidents 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'. Level 3 serious incidents include 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 provisions.

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 transport, 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 event 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 event.

The KEW 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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