



Inspectie Leefomgeving en Transport
Ministerie van Infrastructuur en Milieu

Report on events in Dutch nuclear facilities during 2011

*This document is a translation of Human Environment and Transport Inspectorate - KFD report "Rapportage van ongewone gebeurtenissen in Nederlandse nucleaire inrichtingen in 2011".
In case of textual differences between the original report and this translation the original report is binding.*



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Report on events in Dutch nuclear facilities during 2011

Datum January 22, 2013

Colofon

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Summary

In 2011 fifteen events, that have any relation to nuclear safety and for which reporting is obligatory, have occurred in the Dutch nuclear facilities. Eight of these events took place in the Nuclear Power Plant Borssele and seven events in the other Dutch nuclear facilities. Three out of the fifteen events (all at the Nuclear Power Plant Borssele) are of such importance with respect to nuclear safety that they have been classified on INES level 1. This is the lowest level of the internationally used method to classify the severity of events (the International Nuclear and Radiological Event Scale, INES). The other events are relatively less serious and fall below this scale (INES level 0).

The investigation shows that in 2011 in none of the Dutch nuclear facilities the number of events has differed strongly from previous years. It is to be remarked, however, that in 2011 three events which have been classified on INES level 1 have occurred in the Nuclear Power Plant Borssele. This number has drawn the attention of the KFD, but there is no reason yet to speak of a trend.

For the Nuclear Power Plant Borssele, personnel capacity, communication and performance of the plant remain points of interest. In 2011, the operator of the power plant (EPZ) has expanded their personnel capacity, but in view of the internal training and the familiarisation period required, the positive effects cannot be visible before 2012 at the earliest. Further, attention is continuously being given to the improvement of the communication and working procedures and EPZ has in 2011 given green light to several investment plans which will improve the functioning of the plant. By these measures EPZ expects to reduce the number of events at the nuclear power plant.

Also at other licensees, such as Mallinckrodt Medical and Urenco, events in 2011 have led to closer attention to careful working by the personnel.

The operators of the nuclear facilities have analysed the events which occurred in their facilities, determined the direct and indirect causes and, where necessary, measures have been taken to prevent recurrence in the future.

At the nuclear reactor at Petten (the so-called High Flux Reactor of NRG) a contamination of the groundwater by tritium has been observed. At the moment of drawing up this report NRG had traced the source of the contamination and eliminated it. The KFD monitors the progress of the repair and the cleaning.

The opinion of the KFD is that, also in 2011, the licensees have learned from the events, thus contributing to the continuous improvement of the safety of the nuclear facilities in the Netherlands.

1 Introduction

This report presents a review of the events, that have any relation to nuclear safety and for which reporting is obligatory, which have occurred in 2011 in the Dutch nuclear facilities.

On February 27, 1980 the then Minister of Social Affairs promised to inform the Tweede Kamer (House of Commons) every year on the performance of the Dutch nuclear power plants. The direct cause was the core melt accident on March 28, 1979 in the US Three Mile Island II power plant near Harrisburg.

The Department of Nuclear safety, Security, Safeguards and Radiation Protection (Kernfysische Dienst, KFD) has been charged with the editing of this report. The KFD supervises all facilities in the Netherlands that are operated based on a licence in accordance with article 15 under a or b of the Nuclear Energy Act (Kernenergiewet). In 2011 the KFD was part of the VROM Inspectorate, which in 2012 has merged with the Human Environment and Transport Inspectorate (Inspectie Leefomgeving en Transport).

In the course of the years this reporting has been extended to all nuclear facilities in the Netherlands and the radiological laboratories connected to them.

In this report the reports of the following licensees¹ have been included:

- The Elektriciteits-Produktie maatschappij Zuid-Nederland EPZ (EPZ) at Borsele with the Nuclear Power Plant Borssele (KCB);
- The Central Organisation for Radioactive Waste (COVRA) at Borsele;
- The Technological University Delft with the Reactor Institute Delft (RID) with the University Research Reactor (HOR), the sub-critical ensemble DELPHI and laboratories;
- The Nuclear Research and Consultancy Group (NRG) at Petten with two facilities:
 - The High Flux Reactor (HFR),
 - The Low Flux Reactor (LFR), the Hot Cell Laboratories (HCL), consisting of the Research Laboratory (RL) and the Molybdenum Production Facility (MPF), the Decontamination and Waste Treatment (DWT) and the Waste Storage Facility (WSF);
- The Energy Research Centre Nederland (ECN) at Petten;
- The Joint Research Centre (JRC) of the European Union at Petten;
- Mallinckrodt Medical (MM), a subsidiary of Covidien, at Petten;
- The Joint Nuclear Power Plant Nederland (GKN, Gemeenschappelijke Kernenergiecentrale Nederland) at Dodewaard, which has been taken out of service finally in March 1997 and which since then has been in safe enclosure
- The enrichment plants of URENCO Nederland at Almelo.

For the reported events the INES scale is used. This scale shows the severity of nuclear and radiological events, comparable with the scale of Richter for earthquakes.

¹ The licensees mentioned can be divided into two categories: the licensees in accordance with the Nuclear Energy Act (Kernenergiewet) article 15 under b (EPZ, COVRA, RID, NRG-HFR, NRG-others, GKN and URENCO) and the licensees in accordance with the Nuclear Energy Act article 15 under a, article 29 and article 34 (ECN, GCO and MM).

2 Events in Dutch nuclear facilities in 2011

In this chapter an overview is given of the events, for which reporting is obligatory, which have occurred in 2011 in the Dutch nuclear facilities.

Events feature two important aspects. First is the event itself, the nature and the severity of which must be determined and the consequences eliminated. In addition, it is important that after the occurrence of an event this event is systematically analysed, in order to learn from it and to prevent a recurrence in the future. In this way the safety of the nuclear facilities improves continuously.

Events can occur in various gradations, from seemingly unimportant to very weighty, but they are all taken equally seriously. "Small" events can be a symptom of an underlying larger problem and the simultaneous occurrence of several small events may also have serious consequences. It is therefore necessary to analyse all events thoroughly. In the first instance, this is the task of the licensees of the nuclear facilities. The KFD supervises this.

Based on the Nuclear Energy Act licences granted to the nuclear facilities, the licensees report events which occur in the facility. For every Dutch nuclear facility, reporting criteria have been established that specify which events should be reported to the KFD and which should not.

The total number of events is higher than the number of events shown in this report. The KFD is informed on the other events by means of monthly, quarterly or annual reports, meetings and during inspections.

The events reported below all have been given an INES classification, where INES stands for International Nuclear and Radiological Event Scale. The INES scale is for nuclear events what the scale of Richter is for earthquakes: it indicates the severity of the events.

More information on the INES scale can be found in the Annex.

2.1 Nuclear Power Plant Borssele

In 2011 EPZ, the licensee of the Nuclear Power Plant Borssele, has reported eight events, for which reporting is obligatory, to the authorities. These events are described below.

January 1 2011, INES level 0

The activation of the reactor protection as a result of high secondary steam pressure.

During the start-up of the reactor after a short unscheduled stop the pressure in the feed water supply tank increases fast and unforeseen. The reactor is then shut down manually and the main steam valves are closed. At that moment, the reactor is still subcritical.

In accordance with the procedure the produced steam is blown off through the relief valves. This concerns secondary steam which has not been in direct contact with the core and consequently is not contaminated. Because the reactor has been out of service for some days, relatively little heat is produced and consequently the steam production is low. As a result, only one of the four blow-off control valves opens. The opening angle of the blow-off control valve is very limited. As a result, the closed-position signal of the control valve does not disappear and the control valve is not automatically closed when the pressure drops. To stop the pressure drop, the isolation valves in series with the control valves are closed manually. This leads to an increase of the steam pressure a few times and the subsequent activation of the reactor protection system.

The activation of the reactor protection system has been the reason to report this event to the authorities. EPZ has analysed the course of the event and the underlying causes and taken measures to prevent a recurrence in the future.
The KFD has classified this event on INES level 0.

April 18 2011, INES level 0

The manual activation of a half emergency power situation.

During the start-up after the refuelling stop a short-circuit occurs in the motor of a ventilation fan. As a result, the earth fault monitoring equipment of two power rails is activated and a main coolant pump is switched off. Caused by the heat production in the earth fault monitoring instruments, smoke is produced in a switching room and the fire alarm is activated. The power is then manually switched off from both power rails and the emergency diesels start, providing power to the emergency power rail again. This concerns one of both redundancies of emergency power grid 1, thus the term "half emergency power situation" is applicable. After the automatically switching off of the earth fault measurement, the smoke production stops and after an investigation of the situation the normal electric power supply is restored. Fully in accordance with the procedure, the plant fire brigade of EPZ and the communal fire brigade of Borsele are alarmed, but these did not need to come into action. EPZ has analysed the course of the event and the underlying causes and taken measures to prevent a recurrence in the future.
The KFD has classified this event on INES level 0.

April 28 2011, INES level 0

The automatic shut-down of the reactor, caused by a defective electronics module in the reactor protection system

A defective electronics module in the reactor protection system causes a series of automatic actions, amongst which the shutdown of the reactor by inserting the control rods. The decay heat is then removed temporarily by blowing off secondary (uncontaminated) steam to the environment. By these actions the reactor is taken into a safe condition. The electronics module concerned is periodically tested. The design of the reactor protection system is such that this module cannot fail unnoticed. In such cases the reactor is automatically taken into safe condition, as has also been the case in this event. EPZ has replaced the component and investigated the cause of the defect.
The KFD has classified this event on INES level 0.

June 20 2011, INES level 1

The unscheduled automatic activation of an emergency diesel caused by an erroneous action.

During maintenance of one of the emergency diesel generators because of a failure, the start programme of this diesel is activated unscheduled, as a result of an erroneous action. The feed and the consumers of one of the emergency power rails are then switched off automatically, after which the emergency diesel generator is switched on. Because the subject emergency diesel generator is not operational and only one emergency diesel generator at the time can be connected to a power rail, the feed of the emergency power rails is not immediately restored. This is corrected manually, by which the situation is restored within the prescribed time limit. During the investigation of this disturbance it is found that a defective circuit board has been the cause of the initiating failure. Three other defective circuit boards are also detected. These circuit boards are necessary for the automatic start and connection of the emergency power diesels. Manual starting remained possible. The defective circuit boards had not been detected earlier, because after maintenance the correct standard test for requalification of the emergency diesel had not been executed.

EPZ has analysed the course of the event and the underlying causes and has taken measures to prevent a recurrence in the future.

Although this event is classified on INES level 0 on technical grounds, the KFD has decided to raise the classification to INES level 1, because the emergency power diesel had not been requalified after maintenance with the correct standard test.

June 23, 2011, INES level 0

The automatic activation of the reactor fast shut-off as a result of the switching off of all pumps of the main cooling water system.

The cooling water inlet building of the nuclear power plant contains the main cooling water pumps both for the nuclear power plant and for the adjacent coal-fired power plant. During full power service of both power plants maintenance work is executed on one of the five measuring instruments which measure the water level in the cooling water inlet building. This instrument is therefore disconnected, but during a test during the work the disconnected instrument affects a second measuring instrument, which generates a stop signal for the main cooling water pumps. This is caused by the circumstance that these pumps are switched off when two different switch-off signals are received. It is unnoticed that at this moment one switch-off signal is already being generated, because during the preceding maintenance shut-down of the coal-fired power plant one of the other level indicators has been left in an incorrect position. Therefore, the test of the level measurement leads directly to the switching-off of all main cooling water pumps and thereby to the switching-off of both the nuclear power plant and the coal-fired power plant. EPZ has analysed the course of the event and the underlying causes and has taken measures to prevent a recurrence in the future.

The KFD has classified this event on INES level 0.

July 6, 2011, INES level 1

The unavailability of the emergency feed water system as a result of short-circuit in a control cabinet.

By a short-circuit in an electronics module in a control cabinet the feed of part of the components in this cabinet is cut off and with it the functionality of the systems controlled by these components. As a result, some measurements are eliminated and a number of control functions show anomalous behaviour. This results in opening of the main feed water control valve, by which the level in the steam generator rises. The operating shift personnel manually corrects the deviations, so that the emergency feed water system does not have to go into operation. A closer investigation shows that the loss of the subject part of the control cabinet had also affected the emergency feed water system, which therefore could not automatically fulfil its safety function any more. Manual activation of the emergency feed water system was possible, however.

EPZ has analysed the course of the event and the underlying causes and has taken measures to prevent a recurrence in the future.

The KFD has classified this event on INES level 1.

August 7, 2011, INES level 1

The shut-down of the nuclear power plant for repairs of a decay heat removal circuit in connection with leakage.

During a regular inspection by the shift personnel a leakage of drops is observed near a nozzle on a line of part of the core flooding and decay heat removal system. After a closer inspection that part of the system is declared unavailable and the plant is shut down conform the requirements. The leakage was caused by degradation of the cap on the nozzle, which after closer inspection is found to be manufactured from an incorrect material. A new cap is installed and meanwhile,

during the refuelling stop of 2012, a similar cap in the other part of the core flooding and decay heat removal system is also replaced. The leakage was limited and even in case of full rupture of the cap the core cooling would not have been affected.

EPZ has analysed the course of the event and the underlying causes and has taken measures to prevent a recurrence in the future.

The KFD has classified this event on INES level 1.

November 17, 2011, INES level 0

The reduced availability of the volume control system by leakage at one of the discharge lines.

During full load operation a leakage occurs at the volume control system, directly behind one of the two high-pressure reducers. By means of x-ray inspection a reduction of the wall thickness is found and the high-pressure reducer is declared unavailable. There is no need to shut down the plant immediately.

The underlying cause of this event is a temporary modification of the dimensioning of the valve housing of the reducer, causing cavitation and, as a consequence thereof, an accelerated wall thickness reduction.

EPZ has taken measures to prevent a recurrence in the future.

The KFD has classified this event on INES level 0.

2.2 Other Dutch nuclear facilities

2.2.1 High Flux Reactor (HFR) at Petten

In 2011 one event requiring reporting has occurred at the HFR. Although this event was reported to the KFD in the beginning of 2012, the event took place at the end of 2011 and has therefore been included in the report of 2011.

In addition, in this review an event has been included which does not require reporting, but which is considered to be relevant for this report in view of the nature of the occurrence. It concerns the unauthorised reset of electronic dose meters.

November 25, 2011, INES level 0

Tritium contamination of the groundwater.

On January 2, 2012 NRG reports that during the annual sampling of the groundwater on November 25, 2011 an elevated concentration of tritium (^3H) has been observed in one of the monitoring tubes. The measured concentration amounts to 29 Bq/l. During earlier measurements concentrations of less than 10 Bq/l were measured. In the first instance the discharge of an air-conditioning device of the primary pump building is indicated as the cause of the elevated tritium level. The moisture from this device dripped through a tube into the ground and the liquid was found to contain a small quantity of tritium. However, after correction of this situation elevated tritium levels were still measured in 2012. NRG then started an investigation of the tritium contamination. They increased the number of monitoring tubes and thereby encountered even higher tritium levels that could not be attributed to the air-conditioning of the primary pump building. Under supervision of the KFD NRG has since worked at establishing the cause of the tritium contamination in the groundwater, by means of an expansion of the sampling of the groundwater, a geohydrological investigation and a systematic inspection of the facility for possible leak paths. This has led in November 2012 to the repair of a buried line, through which pool water is pumped during maintenance stops to a temporary storage tank. NRG is preparing measures to remove the present contamination from the groundwater. Based on the estimated quantity of leaked tritium-containing water, the KFD has classified this event on INES level 0.

May 11, 2011, INES level 0

The unauthorised reset of electronic dose meters.

During work at a cooling pump of the reactor pool the electronic dose meters worn by the employees sound. This means that the previously set standard dose limit is exceeded. The employees decide to reset the dose meters and to resume the work, instead of consulting the radiation expert. During the work the employees reset the dose meters three times in total. The resetting has not affected the total dose recording of the employees. NRG has ensured that such a situation will not occur again. The KFD has classified this event on INES level 0.

2.2.2 Other facilities of NRG at Petten²

In 2011 three events requiring reporting have been reported from the "other" facilities of NRG to the authorities.

January 13, 2011, INES level 0

The activation of the iodine alarm in the Molybdenum Production Facility (MPF) as a result of an inadvertently closed valve.

On January 13, 2011 the vacuum tanks of the Molybdenum Production Facility are flushed with helium. Caused by an inadvertently closed valve, the pressure in the supply line increases during the filling of the tanks and the overpressure protection is activated. The exhausted helium is set free in a work space of the MPF. By the venturi action of the overpressure valve a quantity of the iodine present in the solution tank is also set free. The iodine concentration in the subject work space amounted to max. 269 Bq/ m³. The escape of the iodine caused a iodine alarm, after which work spaces were evacuated. The event had no measurable dose consequences for the employees. NRG will take measures to prevent a recurrence. The KFD has classified this event on INES level 0.

June 1, 2011, INES level 0

The use of a transport container with depleted uranium without a valid permit.

On June 1, 2011 it was observed that four transports had taken place with in total eleven transport containers, the permit of which had expired. It concerns containers in which depleted uranium is used as a shielding material. In the Netherlands the use of this type of containers for public road transports requires a permit. After noticing the expired permit, NRG has discontinued the transports and applied for prolongation of the permit. From July 14, 2011 this prolongation has entered into force and the transports have been resumed. The KFD has classified this event on INES level 0.

October 25, 2011, INES level 0

A reduced underpressure in a hot cell leads to activation of the underpressure alarm.

On October 25, 2011 during loading of a transport container the inner container drops into the transport container. The correction of this situation takes much time compared with a normal container loading time. During loading, the transport container is pressed on a hydraulic lifting table against the bottom of the hot cell, whereby a leak-tight connection between hot cell and container is created. By the delay and the weight of the container the oil pressure in the lifting

² The other facilities for which NRG has a licence are the HCL (Hot Cell Laboratories), consisting of the Research Laboratory (RL) and the Molybdenum Production Facility (MPF), LFR (Low Flux Reactor), WSF (Waste Storage Facility), DWT (Decontamination and Waste Treatment), as well as other laboratories, amongst which the Jaap Goedkoop Laboratory (JGL).

table sinks and an air gap between container and hot cell is created. This results in a reduced underpressure in the hot cell, causing the underpressure alarm to be activated. No radioactive substances have escaped and an investigation has shown that no contaminations have been caused. NRG will take measures to prevent a recurrence. The KFD has classified this event on INES level 0.

2.2.3 Central Organisation for Radioactive Waste (COVRA) at Borsele

At the Central Organisation for Radioactive Waste no events requiring reporting have occurred in 2011.

2.2.4 University Research Reactor (HOR) at Delft

At the University Research Reactor no events requiring reporting have occurred in 2011.

2.2.5 Energy Research Centre Nederland (ECN) at Petten

At the Energy Research Centre Nederland no events requiring reporting have occurred in 2011.

2.2.6 Joint Research Centre (JRC) of the European Union at Petten

At the Joint Research Centre of the European Union no events requiring reporting have occurred in 2011.

2.2.7 Mallinckrodt Medical (MM, a subsidiary of Covidien), at Petten

At Mallinckrodt Medical no events requiring reporting have occurred in 2011. Below, one event observed by MM is described which, although not requiring reporting, is considered to be relevant for this report, in view of the nature of the occurrence.

2011, INES level 0

Manipulation of transport index of molybdenum-technetium generator.

Three employees of Mallinckrodt have manipulated the measurements, from which the transport index of molybdenum-technetium generators is derived, by holding a hand between the measurement equipment and the generator. The transport index is used to indicate the radiation level around a package. By the manipulations the contribution of a possible radioactive contamination in the generators was not included into the transport index. The reasoning of the employees was that during the later transport this contribution would not be relevant any more because of decay.

An internal investigation has shown that the dose limits which apply for packages and transports had not been exceeded.

MM has discharged the employees concerned and has made a culture inquiry by an external bureau. At present specific trainings are being organised.

2.2.8 Joint Nuclear Power Plant Nederland (GKN,) at Dodewaard

The Dodewaard Nuclear Power Plant has been finally taken out of service on March 26, 1997. All fuel has been removed from the reactor and transported from the site. Dispensable systems have been disconnected and, if necessary, cleaned. Then the power plant has been taken out of service. The systems which had been taken out of service have been conserved and locked.

Architectural adaptations have been made and new systems installed.

On July 1, 2005 the waiting period for the power plant in safe enclosure until the dismantling after 40 years, has started.

At the Dodewaard Nuclear Power Plant no events requiring reporting have occurred in 2011.

2.2.9 URENCO Nederland at Almelo

At URENCO two events requiring reporting have occurred in 2011.

April 16, 2011, INES level 0

A small fire in the electrical equipment in a workspace leads to automatic activation of the fire alarm system and the action of the BHV-organisation and the communal fire brigade of Almelo.

After a fire alarm the inspector of the BHV organisation detects smoke emerging from an inverter which is in operation at that moment. After switching off the inverter and the corresponding feed, the beginning fire is extinguished with the assistance of the communal fire brigade of Almelo. It is concluded that the cause of the fire is a manufacturing error of the inverter. The inverters are periodically monitored, but this cannot always prevent such a disturbance. The countermeasures that have been taken were executed in accordance with the planning and have shown to be adequate.

KFD has classified this event on INES level 0.

December 6, 2011, INES level 0

Leakage of the evaporation equipment for uranium-containing water as a result of corrosion and a missing blank.

On December 6, 2011 leakage is observed at an evaporation device. In this device radioactive waste water is concentrated, in order to be able to transport the residue to COVRA.

As a result of internal corrosion a flange of the evaporator has started to leak. The escaped liquid is collected in the collecting tray. To stop the leakage, the water which is still in the system is transferred to a back-up storage tank. However, during transferring leakage occurs again, because a blank on the subject storage tank is missing. As a result, part of the waste water flows through the flange aperture onto another floor.

URENCO has taken measures to prevent a recurrence.

KFD has classified this event on INES level 0.

2.2.10 Transport of radioactive materials

August 24, 2011, INES level 0

Upon arrival the wagons of a rail transport do not point in the correct direction, such that unloading of the transport containers is not possible.

Although this event strictly speaking has been reported by COVRA, it took place outside of the COVRA site during transport. For this reason the report has been included in this report under the denominator "transports". The responsible for the transport in the Netherlands is the holder of the transport licence in the Netherlands, DB Schenker.

On August 24, 2011 COVRA reports that the goods wagons of a rail transport from France with compacted residues upon arrival point in the wrong direction. As a result, the orientation of the packages is such that the supplied material cannot be unloaded. This situation is a result of a lack of supervision of the orientation of the wagons when shunting during the transport. With the aid of a crane and under supervision of the KFD, the packages are turned around, after which unloading of the material is possible. DB Schenker has taken measures to prevent a recurrence in future. KFD has classified this event as INES level 0.

2.3 Dutch INES reports to the IAEA in 2011

In 2011 no reports were made by The Netherlands to the IAEA.

3 KFD analysis of Dutch events in 2011

In 1980 the Parliament has requested to be informed on the performance of the Dutch nuclear facilities. In chapter 2 of this report the events in 2011, for which reporting is obligatory, are summed up for the various Dutch facilities.

To translate these into an analysis how these facilities have functioned, a number of questions must be answered: How serious were these events? How did the licensees cope with these events? Is the situation improving or deteriorating? How is the Dutch situation relative to the international state of affairs and are these events an indication for possible other issues?

To the first question, how serious were these disturbances, an answer can be given with the aid of the INES classifications given to them. Of the fifteen events in 2011, for which reporting was obligatory, twelve are "relatively unimportant" (below-scale, INES level 0) and three of some importance (INES level 1).

When the INES scale was conceived in 1989, the idea was that this scale should be constructed so that in a "normal" nuclear facility about ten INES level 0 and one INES level 1 events would occur annually. In this respect the three INES 1 reports which occurred in 2011 at KCB draw the attention. This is discussed in more detail in par. 3.1.

With respect to the second question, i.e. how the facilities have reacted to the observed events, the KFD notices that the licensees have reported timely and correctly. All the licensees have been able to show that they make efforts to learn from the events which have occurred and that they take measures, where necessary, to prevent a recurrence.

The question whether the situation has become better or worse in 2011 than in preceding years and whether the Dutch nuclear facilities perform better or worse than in other countries, cannot be simply answered, however. This has the following reasons:

- The statistics of the data are meagre. There are (too) few data to support a sound judgement.
- The INES scale does give a good insight into the severity of a situation, but it does not give a judgement whether for instance two INES level 0 events are more or less serious than one INES level 1 event.
- The obligatory reporting threshold for the INES system internationally lies on minimum INES level 2. The Dutch events described in this report are all lower: INES level 0 or 1.
- The reporting criteria always give room to interpretations. This means that an increase in the number of reports by greater reporting willingness could possibly be wrongly seen as a deterioration of the situation.

For information Table 1 gives an overview of the events, for which reporting was obligatory, occurred from 1997 to 2011, split up into the Nuclear Power Plant Borssele (KCB) and the other facilities. Table 1 also contains an overview of all events with an INES level higher than 0, for KCB and for the other facilities.

The question, whether the reported events are a signal for underlying issues, is discussed in more detail in the following two paragraphs.

Year	TOTAL			INES > 0		
	Total	KCB	Others	Total	KCB	Others
2011	15	8	7	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
2004	21	8	13	3	0	3
2003	18	6	12	3	1	2
2002	19	10	9	1	0	1
2001	18	9	9	3	2	1
2000	23	12	11	2	2	0
1999	14	8	6	2	1	1
1998	21	10	11	2	1	1
1997	26	15	11	2	1	1

Table 1: The number of event reports, for which reporting was obligatory, of KCB and other nuclear facilities during the past fifteen years.

3.1 Nuclear Power Plant Borssele

As described in Chapter 2, in 2011 eight events, for which reporting was obligatory, have occurred at KCB, of which three events were classified on INES level 1. The occurrence of three INES 1 events in one calendar year has drawn the attention of the KFD, but there is no reason yet to speak of a trend into the wrong direction.

A discussion of the events, which occurred in 2011, both those for which reporting was obligatory and those for which reporting was not obligatory, brings to light the following points of interest: capacity, communication and the functioning of the plant. In 2011 EPZ has expanded the personnel capacity of KCB. In view of the internal training and the familiarisation period required, the positive effects cannot be visible before 2012 at the earliest.

When operating and maintaining a complex plant, the importance of communication is always great and increases as the staff of KCB is replaced by younger persons. EPZ continues to give attention to this, both by training and by work discussions prior to the work.

In 2011 EPZ has given green light to several investment plans which will improve the functioning of the plant and reduce the occurrence of events in this field. The planned modernisation of the maintenance strategy at KCB, which will be realised in the framework of the lifetime extension of KCB, will also contribute to this.

The KFD is of the opinion that EPZ in this way effectively learns from the events to make the necessary improvement steps. The KFD remains informed on the progress and the effectiveness of the subject improvement programmes, carries out inspections on the site and applies enforcement instruments where necessary to enhance the compliance.

3.2 Other Dutch nuclear facilities

At the other Dutch nuclear facilities, in 2011 seven events, for which reporting was obligatory, have occurred. With respect to preceding years this is a relatively low number. All reported events were classified as below scale (INES level 0). These events were divided between ten

licensees. Of these, the former nuclear power plant at Dodewaard, the University Reactor at Delft, the Central Organisation for Radioactive Waste, the Energy Research Centre Nederland and the Joint Research Centre at Petten did not submit a report. For the other licensees the number and the nature of the reports did not differ strongly from preceding years.

In all cases the occurred events have led to an analysis of the event, the direct and indirect causes, and measures have been taken to prevent the possibility of a recurrence in the future. An exception to the above is the tritium contamination of the groundwater near the HFR at Petten. At the moment of drawing up this report, NRG had traced and stopped the source of the contamination. The KFD monitors the progress of repairs and cleaning.

The KFD is of the opinion that the licensees in this way effectively have learned from the events to make the necessary improvement steps. The KFD continues to receive information on the progress and the effectiveness of the measures which have been taken, carries out inspections on the site and applies enforcement instruments, where necessary to enhance the compliance.

Annex A INES classification

To all events, for which reporting is obligatory, an INES classification is given. For this purpose 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 Co-operation and Development (OECD) is used.

To explain the severity of events in nuclear facilities worldwide to the public in consistent terms, an INES classification is used which increases from level 1 to level 7.

The Nuclear Energy Act licences and the Technical Specifications of a facility prescribe when an event must be reported. These Dutch rules are more stringent than those of INES. Consequently, there are a number of events that the licensee must report and subject to a closer safety analysis, which are not relevant on the basis of the INES criteria. These light events, which are not significant to the nuclear safety and are therefore situated below this nuclear scale, are classified as INES level 0, or "below scale".

For the levels 1 up to and including 3 the following definitions apply:

- Level 1 is an anomaly or a disturbance. This concerns events during which e.g. the limits of the operating conditions are exceeded. Examples are involuntary exposure of a member of the public to a radiation dose of more than 1 mSv per year inside, and 0,1 mSv per year outside a facility where radioactive sources are used (the legal limit), the finding or loss of a small radioactive source, an exceeding of the (Safety) Technical Specifications of a nuclear facility which is not corrected timely, or a small leak of the primary system of a nuclear power plant.
- Level 2 is an incident. This concerns events during which the safety level is affected. Examples are an exposure of a radiological worker to more than 20 mSv per year (the legal limit), the loss or the finding of a larger radioactive source, involuntary exposure of a member of the public to more than 10 mSv, or a large leak in the primary system of a nuclear power plant.
- Level 3 is a serious incident. This concerns events in which the level of safety is further affected, but still just without an accident occurring. Examples are an excessive irradiation by which (permanent or temporary) physical damage is caused, ten or more persons who receive a level 2 dose (see under level 2), the loss or the finding of a very large radioactive source, exposure of a radiological worker to more than 200 mSv and occurring of radiation levels above 1 Sv/h in a work accommodation.

The other levels are not considered in this report, because they have not been encountered in 2011 and the previous years in the Netherlands.

Events on INES level 2 and above must be reported to the IAEA by the over 70 countries participating in the INES scale.

The INES classification is not only applicable to nuclear facilities, but also to other events, such as excessive irradiations, transports, events with radioactive sources and equipment, accelerators and, since the beginning of 2007 on an experimental base, medical events. Non-civil events and nuclear terrorism are outside of the INES regime.

The accident, which has been the direct cause to start the annual reporting of events to the House of Commons (in the US Three Mile Island II Nuclear Power Plant near Harrisburg on March 29, 1979), was classified on INES level 5.

The accident at Fukushima, Japan, on March 11, 2011 is the second accident on INES level 7 after the accident in the nuclear power plant at Tsjernobyl, Ukraine, on April 26, 1986. The accident at Fukushima was initially classified on March 18, 2011 on level 5 on the INES scale. However, as of April 12, 2011 the classification was increased to INES level 7. This classification was done on the basis of the estimated radioactive emissions that have occurred. The classification is still characterized as "preliminary", because uncertainty still exists about the exact quantity of released radioactive material.

In view of the experience recently obtained with the INES scale with respect to the nuclear accident at Fukushima, the IAEA has investigated whether the INES scale needs to be adapted. From this investigation it has been concluded that the scale does not have to be adapted, but that preliminary classifications should be treated with more restraint. A classification can only be made when the event has entered a stable phase and a reliable picture of the final consequences has been obtained. Member states are stimulated to record INES reports within 24 hours, but these 24 hours are counted from the moment that a reliable and stable picture is defined and not from the beginning of the event.

More information on the INES scale can be found on the website of the IAEA.

A general brochure under:

<http://www.iaea.org/Publications/Factsheets/English/ines.pdf>

The user's manual with all details of the classification under:

http://www-pub.iaea.org/MTCD/publications/PDF/INES-2009_web.pdf

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January 2013