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Report on events in Dutch nuclear facilities during 2013

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Report on events in Dutch nuclear facilities during 2013

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Summary

In 2013 sixteen events¹ have occurred in the Dutch nuclear facilities. Four events took place in the Nuclear Power Plant Borssele and twelve events in the other Dutch nuclear facilities.

Three out of the sixteen events are of such importance with respect to nuclear safety that they have been classified on INES level 2². These are events featuring a significant failure of safety measures, without resulting in actual consequences to man or environment. The three INES level 2 events took place at NRG at Petten.

In addition, four events have been classified on INES level 1. These involve small problems with safety relevant equipment whereby the safety has not been at stake, because sufficient safety barriers (defence in depth) were still intact. One of these events took place in the Nuclear Power Plant Borssele and three in the High Flux Reactor at Petten. The other events are of less importance with respect to nuclear safety and lie below the INES scale (INES level 0).

At the Nuclear Power Plant Borssele there are no special developments to report related to events. In 2013 few (four) events have been reported, as in the preceding year.

KFD notices that since some years EPZ is giving special attention to the reduction of the number of malfunctions by means of improving its internal communication and its operating processes and the implementation of various investments, intended to improve the operation of the plant. Although it is still too early to draw final conclusions, the relatively low number of reported events in the last two years is in line with this intention.

For the facilities managed by NRG at Petten the number and the severity of the reported events can be called exceptional. In 2012 an intensified surveillance was dictated to NRG by KFD. In 2013, the frequency of this intensified surveillance has been further increased, also due to the occurrence of these events. As a consequence of these events, NRG has halted the operation of all facilities at Petten in the middle of 2013. Then, NRG has started a large-scale improvement programme. After the realisation of fundamental measures KFD has approved the restart of the High-Flux Reactor in February 2014 and, under conditions, the resumption of the production of medical isotopes in the Molybdenum Production Facility (MPF) in March 2014. As of May 21, 2014 KFD has reduced the

¹ In this report, as events have been considered those occurrences / malfunctions which are of importance for the nuclear safety. Those are practically all malfunctions which have to be reported at once to KFD in the framework of the Nuclear Energy Act licence plus occurrences which, although they do not have to be reported, are considered by KFD to be of importance for the nuclear safety.

² See Annex A for an explanation to the INES scale.

frequency of the intensified surveillance programme to the surveillance level prior to October 2013.

At the other Dutch nuclear facilities four events have occurred in 2013. Compared to earlier years this is a normal number. All four of these events have been classified on INES level 0.

The INES classification is determined both on the basis of the severity of the incident itself and on the basis of the circumstances related to the incident. This year, the INES-1 classifications are based in particular on the fact that in those events "ageing of the plant" was involved and/or imperfections in "corporate culture" have been observed. It is found that operating procedures are not always strictly adhered to.

In 2013 KFD has given much attention to the undesired occurrences at the HFR and the MPF of NRG. The surveillance of the observed technical and organisational problems and the studies and repairs executed as a result required much priority and effort by KFD.

On the basis of the available information KFD concludes in general that the operators of the nuclear facilities have generally speaking carefully handled the events occurring in 2013 in their facilities. The causes have been determined and, where necessary, measures have been taken to prevent a recurrence in the future. In 2014 KFD will give specific attention to the situation at NRG at Petten.

KFD will continue to inquire about the progress and the effectiveness of the measures taken. KFD will do inspections on site and, where necessary, KFD will apply enforcing instruments to enhance the compliance.

Finally, an overview of all events:

Facility	Total number of events	INES level 0	INES level 1	INES level 2
Nuclear Power Plant Borssele	4	3	1	-
High Flux Reactor, Petten	6	1	3	2
Other facilities of NRG, Petten	2	1	-	1
Central Organization for Radioactive Waste, Nieuwdorp	-	-	-	-
University Research Reactor, Delft	-	-	-	-
Energy Research Centre Nederland, Petten	-	-	-	-
Joint Research Centre, Petten	-	-	-	-
Mallinckrodt Medical, Petten	1	1	-	-
Joint Nuclear Power Plant Nederland, Dodewaard	-	-	-	-
URENCO Nederland, Almelo	3	3	-	-

1 Introduction

This report presents an overview of the events which have occurred in 2013 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 in writing on the performance of the Dutch nuclear power plants.

Over the years this reporting has been extended to all nuclear facilities in the Netherlands and the radiological laboratories connected with them.

The authorities want to inform the citizens more actively. Therefore, since the beginning of 2013 the events in the nuclear facilities are placed up-to-date on the website of the ILT.³

The Department of Nuclear safety, Security, Safeguards and Radiation Protection (Kernfysische Dienst, KFD) has been charged with the editing of this report. 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). KFD is part of the Human Environment and Transport Inspectorate (Inspectie Leefomgeving en Transport).

In this report the reports of the following licensees⁴ have been recorded:

- o The Elektriciteits-Produktie­maatschappij Zuid-Nederland (EPZ) at Borsele with the Nuclear Power Plant Borssele (KCB);
- o The Central Organisation for Radioactive Waste (COVRA) at Nieuwdorp;
- o The Technological University Delft with the Reactor Institute Delft (RID) with the University Research Reactor (HOR), the sub-critical ensemble DELPHI and laboratories;
- o 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, consisting of the Research Laboratory (RL), and the Molybdenum Production Facility (MPF), the Decontamination and Waste Treatment (DWT) and the Waste Storage Facility (WSF);
- o The Energy Research Centre Nederland (ECN) at Petten;

³ <http://www.ilent.nl/onderwerpen/leefomgeving/milieu/nucleaire-veiligheid/ongewone-gebeurtenissen-2013>

⁴ 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).

- o The Joint Research Centre (JRC) of the European Union at Petten;
- o Mallinckrodt Medical (MM), a subsidiary of Covidien, at Petten;⁵
- o 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;
- o The enrichment plants of URENCO Nederland at Almelo.

⁵ Since July 1, 2013 the name of the company has been changed into Mallinckrodt Pharmaceuticals and the company is no longer part of Covidien.

2 Events in Dutch nuclear facilities in 2013

In this chapter an overview is given of the events, which have occurred in the Dutch nuclear facilities in 2013.

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. This contributes in an important degree to the continuous improvement of the safety of the nuclear facilities.

Events can occur in various gradations, from seemingly unimportant to very weighty, but they must all be taken equally seriously. "Small" events can be a symptom of an underlying larger problem and the simultaneous occurrence of several small events may have serious consequences. It is therefore necessary to record and analyse all events thoroughly. This is the task of the licensees of the nuclear facilities. KFD supervises this. Based on the Nuclear Energy Act licences granted to the nuclear facilities, the licensees must report events which occur in the facility. For every Dutch nuclear facility, reporting criteria have been established that specify which events must be reported to KFD and which must not. The total number of events is in every facility higher than the number of events shown in this report. KFD is informed on these 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 is given in Annex A.

2.1 Nuclear Power Plant Borssele

In 2013 EPZ, the operator of the Nuclear Power Plant Borssele (KCB), has reported four events to the authorities. These events are described below.

January 29, 2013: Damage of part of the emergency power supply; INES level 1

On January 29, 2013 EPZ reports that on that day, while the nuclear power plant is in operation, a part of the internal emergency power supply system is malfunctioning. The power plant is then taken out of service. The loss of the part of the emergency power supply system is due to a damage which has occurred during work on this system. During testing of electrical equipment and the subsequent starting of a pump a short-circuit

had been caused in a control cabinet. As a result of the short-circuit heat had been generated in the control cabinet, which has caused the damage. In agreement with the licence the power plant has been brought in a shut down state in a controlled way. The damage to the electrical system has been repaired, the safety provisions have been tested and afterwards the power plant has been connected to the grid again.

During the event KFD has monitored on-site the approach to the incident and the safe shut-down of the plant. After an investigation of the direct and underlying causes of the breakdown, EPZ has taken additional measures to prevent a recurrence of this event. Also, measures have been taken to limit the consequences of this type of short-circuit for the power plant.

KFD has classified the event on INES level 1, because the underlying cause of this event had not been detected by the standard tests.

August 12, 2013: Activation of the emergency power supply diesels by power failure; INES level 0

On August 12, 2013 EPZ reported that the 10 kV electrical auxiliary power supply of the nuclear power plant Borssele had failed because of a breakdown in the grid outside of the plant.

In agreement with the design of the plant, the emergency power supply diesels, which replace the relevant auxiliary power supply, started automatically. All emergency and safety systems have performed adequately. After about one hour the breakdown in the grid outside the plant was repaired. During the power failure the reactor has remained in service.

KFD has investigated how EPZ has responded to the disturbance in the external grid. No irregularities were found. This event has been classified on INES level 0.

August 19, 2013: Increase of quantity radioactive substances in primary cooling water by leakage of fuel rod; INES level 0

On August 19, 2013 EPZ observed an increase of the quantity of Xenon-133 in the primary cooling water. Xenon-133 is a radioactive gas which is formed during the nuclear fission process. The increase was due to a (gas) leakage from a fuel rod. The primary cooling system is a closed circuit inside the safety containment of the nuclear power plant. Radioactive substances which are present in the primary cooling water do not enter the environment. The maximum quantity of radioactive substances in the primary cooling water is specified in the Technical Specifications of the nuclear power plant, because an increase of the activity of the primary cooling water may influence the exposure of personnel to radioactive radiation and may have consequences to the environment if an accident would occur. The observed increase was well below the limit as laid down in the Technical Specifications. During the next refuelling stop the leaking fuel element was detected and removed from the reactor for repair. An investigation by EPZ into the cause of the leakage is still ongoing and is being followed by KFD.

KFD has classified the event on INES level 0.

December 18, 2013: Unintentional opening of a coupling switch and subsequent unforeseen loss of auxiliary systems; INES level 0

During a routine test on December 18, 2013 of the availability of the emergency power supply a malfunction has occurred. In case of an electrical power failure an emergency power rail supplies power, generated by a generator, to a number of vital parts of the power plant, such as the emergency cooling system.

During the failure of the emergency power rail the voltage level in the rail exceeded the normal operating value. The vital parts of the power plant kept functioning. However, some auxiliary systems of the emergency power generator failed unexpectedly. A lubricating oil pump and a booster pump were involved. As a consequence, a part of the emergency power generator could not be operated automatically any more. Manual operation remained possible. The unforeseen failure of these pumps was soon detected and corrected.

EPZ will investigate the malfunctioning in the emergency power supply and the unintentional failure of the pumps more closely.

KFD has executed an inspection of the cause of this event and will check the further investigation of EPZ. On the basis of the data which are available up till now, this event has been classified on INES level 0.

2.2 Other Dutch nuclear facilities

2.2.1 High Flux Reactor (HFR) of NRG at Petten

In 2013 six events have occurred at the HFR, which were reported to KFD.

February 19, 2013: Error in safety analysis HFR; INES level 2

On February 19, 2013 the Nuclear Research Group (NRG) reports that an error has been found in the safety analysis of the High Flux Reactor (HFR). The objective of a safety analysis is to show that the facility, in case of incidents, such as the rupture of an inlet line or an outlet line of the reactor vessel, remains stable for at least 30 minutes, without requiring interventions by operators.

It was found that the diameter of one of the lines (the primary drain line) is larger than the diameter of the lines used in these analyses. A possible rupture of this line could lead to a leakage rate which is higher than calculated in the safety analysis. This means that the operators, in case of an actual rupture of the line, would possibly have too little time to intervene and that the reactor core could not be sufficiently cooled. Because the reactor was already in a shut down state because of a breakdown which had been observed earlier, no immediate measures were necessary. NRG has modified the subject line in such a way that in case the line would be damaged the leakage rate remains within the value analysed in the safety analysis.

KFD has evaluated the modification proposed by NRG and monitored the execution of the modification. On June 3, 2013 KFD has given permission to NRG to restart the HFR.

Because by the large diameter of the line the operators possibly would have too little time to intervene when a leakage would occur and because the reactor core would then not be cooled sufficiently, KFD has classified this incident on INES level 2. This is an event when safety provisions fail without causing actual consequences to man or environment.

KFD is obliged to report events of INES level 2 or higher to the IAEA and has actually done so for this event.

July 19, 2013: Glitch in the radioactivity measuring system in the ventilation air of the reactor hall; INES level 1

On July 11, 2013, after the reactor had been shut down for maintenance, NRG has detected a glitch in the measuring equipment which monitors the quantity of radioactive substances that are discharged through the ventilation system of the reactor hall to the atmosphere. When this measuring equipment indicates high values, the stack of the HFR is closed. NRG has reported this breakdown on July 19, 2013. By then, the technical glitch had meanwhile been repaired. KFD has established by inspection that the glitch has lasted for at least two weeks, while the reactor was in operation. During the whole period in which the measuring equipment had malfunctioned there has been no increased radioactivity in the reactor hall. Consequently, this disturbance has not led to unforeseen discharges into the atmosphere.

KFD has addressed NRG for the not-timely detection of the violation of the Safety Technical Specifications and has applied enforcing instruments, because of the delayed reporting of this event.

Because NRG had not recognised this breakdown in time as an exceeding of the Safety Technical Specifications, KFD has classified this event on INES level 1.

August 28, 2013: Temporary incorrect setting of protection against too high reactor power; INES level 1

NRG has reported that on August 28, 2013, during start-up of the reactor after a maintenance stop, the setting of one of both protection systems against too high reactor power was temporarily selected on a too high value. These protection systems must ensure that the reactor is switched off when the power threatens to exceed the maximum licensed value. Prior to every operating cycle the protection system must be calibrated. By an error during the calibration the actually set value was higher than allowed according to the Safety Technical Specifications. NRG has detected the deviation and corrected it.

KFD has classified this event on INES level 1, due to the occurring of several human errors and the failure to follow procedures.

August 28, 2013: Fuel element loaded upside down into core; INES level 1

On August 28, 2013 NRG reports that during the preceding operation cycle a fuel element has stood upside down in the core. After a first analysis of

the events NRG believes that the cause was the falling of the element, prior to the operating cycle, from the hoisting equipment into the reactor pool. After this fall the element has been lifted again and inspected for damage. It was found that the element was not damaged and it was finally placed again into the reactor. During an inspection of the element after the operating cycle it was observed that the element stood upside down. Looking back at the inspection pictures of the element prior to the last cycle, it was found that the element was also then suspended upside down in the hoisting equipment. Whether the element has actually stood upside down in the core NRG could not confirm, nor deny.

NRG has carried out an investigation of the cause of this disturbance and the possible consequences which the upside down positioning could have had if this had happened with an element with less burn-up. KFD has classified this event on INES level 1, because of the careless handling of an abnormal situation, i.e. the fall of a fuel element.

September 19, 2013: Too low set value of pressure protection in irradiation object in the HFR; INES level 0

On September 19, 2013 NRG reports that the pressure protection of an irradiation capsule, which is placed in the HFR, is set too low. The irradiation capsule is used to produce molybdenum. The pressure protection of the object serves to detect in time a possible lack of cooling capacity in the capsule. NRG has established that during the period in which the pressure protection was set too low the cooling has been intact. NRG investigates the cause of this error and the measures to be taken. KFD will check the investigation and the measures taken for effectiveness. KFD has classified this event on INES level 0.

September 26, 2013: Abnormality of control rod; INES level 2

On September 26, 2013 NRG has reported that during the regular maintenance stop of the HFR an abnormality of one of the six control rods has been observed. On the basis thereof NRG has decided not to start up the reactor again, but to carry out first an investigation of the cause and the possible solution. During this investigation it was found that two other control rods also showed comparable abnormalities to a lesser extent. The abnormalities could be traced back to unsuitable connections between two components of the control rods. NRG has improved the design of the control rods and taken measures to prevent a recurrence in the future. Also, this event, together with other events mentioned above, has been the reason for the execution of a large-scale improvement programme of the management of NRG, inclusive of the HFR: the "Return 2 Service" programme.

On February 10, 2014 KFD has issued a declaration of no objection for the restart of the HFR, on the basis of the handling of these and other events, the measures which have been taken subsequently and the measures which are still in execution.

KFD has classified this event on INES level 2, because of the occurrence of a failure mechanism which can lead to damage of several control rods together (common cause failure).

KFD is obliged to report events of INES level 2 or higher to the IAEA and has actually done so for this event.

2.2.2 Other facilities⁶ of NRG at Petten

In 2013, from the other facilities of NRG two events have been reported to the authorities.

October 17, 2013: Too high uranium concentration in liquid waste tank; INES level 2

On October 17, 2013 NRG reports that the concentration of uranium (U-235) in one of the liquid waste storage tanks of the Molybdenum Production Facility (MPF) appears to be higher than specified in the licence. In the tank liquid waste is stored. The tank is located in the Molybdenum Production Facility in which materials are produced for diagnostic investigation in hospitals. The waste is temporarily stored in tanks, awaiting transport to a processor (COVRA at Vlissingen). Conform the request by KFD, NRG has, as a precaution, stopped operation of the subject facility and submitted to KFD a plan of action with measures. KFD has evaluated the investigation of the cause, the severity and the solution for this situation. By means of closer investigation NRG has established that after all the uranium concentration had not exceeded the limits defined in the licence.

After cleaning of the first storage tank of liquid uranium-containing waste and the realisation of a number of measures, NRG has partially resumed the molybdenum production in the MPF in April, 2014.

KFD has classified this event on INES level 2, because at the time barriers to prevent a possible accident, whereby a nuclear reaction could be caused, were mostly lacking.

KFD is obliged to report events of INES level 2 or higher to the IAEA and has actually done so for this event.

December 13, 2013: Loss of ventilation Water Treating Building (DWT); INES level 0

On December 13, 2013 NRG reports that during a power failure in the external grid the air ventilation in the water treating building has malfunctioned. In that building radioactive waste water is purified. The ventilation air is first filtered before it is exhausted to the atmosphere. In case of a power failure the ventilation must remain in operation. Therefore, the ventilation must be connected to the emergency power grid of NRG at all times. During the power failure it was found that this was not

⁶ 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).

the case. NRG carries out an investigation of the cause of this design error.

KFD will evaluate the results of the investigation.

Meanwhile NRG has taken measures to ensure that the ventilation continues to function also in case of a power failure.

KFD has classified this event on INES level 0.

2.2.3 Central Organisation for Radioactive Waste (COVRA) at Nieuwdorp (Municipality Borsele)

At COVRA no events requiring reporting have occurred in 2013.

2.2.4 University Research Reactor (HOR) at Delft

At the University Research Reactor no events requiring reporting have occurred in 2013.

2.2.5 Energy Research Centre Nederland (ECN) at Petten

At the Energy Research Centre Nederland no events requiring reporting have occurred in 2013.

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 2013.

2.2.7 Mallinckrodt Medical⁷ (MM) at Petten

At Mallinckrodt Medical one event requiring reporting has occurred in 2013.

June 8, 2013: Contamination of hands of employee by Mo-99; INES level 0

An employee is unexpectedly contaminated by Mo-99 during work with non-radioactive products. This has led to a calculated skin dose of 290 mSv on one cm². The source of the contamination has been determined and removed. Also, Mallinckrodt has taken measures to prevent a repetition in the future.

⁷ Until July 1, 2013, Mallinckrodt Medical was a subsidiary of Covidien and since that date is called Mallinckrodt Pharmaceuticals.

On account of this report KFD has carried out an inspection at Mallinckrodt, together with the Inspection of SZW (Ministry of Social Affairs).

KFD has classified this event on INES level 0.

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. The fuel has been removed from the reactor and transported from the site. Dispensable systems have been switched off 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 a waiting period of 40 years has begun. After this waiting period the power plant will be dismantled.

At the Nuclear Power Plant Dodewaard no events have occurred in 2013.

2.2.9 URENCO Nederland at Almelo

In 2013 three events have occurred at URENCO, which were reported to KFD.

January 22, 2013: Piping leakage of waste water into production room; INES level 0

On February 14, 2013 URENCO reports that on January 22 waste water has leaked into a production room. The waste water comes from a tank in which water used for hand washing is collected. This water may possibly be contaminated with uranium.

Because the leakage has not been detected at once, in total about 700 l water has flown into the room, a small quantity of which has flown below a door to an adjacent room in the same building. The leaked water has been inspected for the presence of uranium. This was found to be not the case. Consequently, by this event no radioactivity has been released.

URENCO has repaired the piping and adapted the work procedures such that the risk of new leaks in this plant is minimised.

KFD has classified this event on INES level 0.

July 27, 2013: Leakage of waste water into production room; INES level 0

URENCO has reported that on July 27, 2013 in a production room a leakage of waste water has occurred, because a storage water tank with waste water used for hand washing has overflowed. The waste water collected on the floor of a production room. The discharge pump of the tank had failed, whilst there was still supply of condensate water, coming from a ventilation system.

URENCO has cleaned away the leakage, repaired the pump and disconnected the supply of the condensate water of the ventilation system. This is possible because this water is not radioactive contaminated and can be discharged through the sewer of the factory. Inspection of the working area concerned did not show radioactive contaminations.

KFD has classified this event on INES level 0.

November 19, 2013: Leaking steam heating spiral in waste water treating plant; INES level 0

URENCO concentrates certain streams of waste water produced in their factory, to be able to dispose the radioactive substances present in that water in concentrated form to COVRA. URENCO reports on December 19, 2013 that on November 19, 2013 a leak has formed in a steam heating spiral which is used for this concentrating process. By this leakage small amounts of radioactivity have unintentionally entered the steam installation. The "boiler water" from this steam installation is periodically discharged into the community sewer, the water of which is cleaned in a sewer water cleaning facility, before it is discharged into the surface water.

After detection of the defect, the steam installation has been taken out of service, cleaned and repaired. Investigation by URENCO showed that the factory sewer had not become contaminated as a result of this internal leakage. In future URENCO will inspect such "boiler water" before discharge for possibly present radioactive substances.

KFD has classified this event on INES level 0.

2.3 Dutch INES reports to the IAEA in 2013

Events from INES level 2 are obligatory reported by the over 70 countries participating in INES to the IAEA (International Atomic Energy Agency). The purpose of these reports is to inform the outside world in an early stage about the nature and the severity of these events.

In 2013 three INES reports were made by The Netherlands to the IAEA. All reports are INES level 2 reports. Two of them have reference to the HFR at Petten. These are the report of February 19, 2013 of the error in a safety analysis and the report of September 2013, 2013 of the damage to the control rods. The third report is the too high uranium concentration in the MPF at Petten on October 17, 2013.

In addition, the IAEA requires the participating countries to report analyses of serious malfunctions in nuclear facilities internationally, to enable other countries to learn from these events. As an aspect of the pursuing of continuous improvement, this knowledge is actively distributed among the national nuclear supervising authorities and the

nuclear companies in the participating countries. The malfunctions and analyses are discussed in international working groups.

In most cases, the reports are related to events with a "weight" of INES-1 and higher. However, the most important criteria is that lessons of the report can be learned by other countries, so that the risk of a repeat in an other facility, than that in which the malfunction originally occurred, is reduced. The reports are included in data bases. There are data bases for different nuclear activities and purposes⁸.

The Netherlands complies with this IAEA requirement by checking annually whether malfunctions requiring reporting have occurred and by reporting the relevant occurrences.

In 2013 two IRS reports were made by The Netherlands to the IAEA about events at the Nuclear Power Plant Borssele on April 1, 2010 and July 6, 2011. These concerned the degradation of the cooling water lines to and from the river Westerschelde as a result of ageing and the temporary unavailability of the automatic control of the emergency feed water system of the reactor. These events have been reported in earlier editions of this report.

Finally, a IRSRR report was made by The Netherlands to the IAEA about the error in a safety analysis of the HFR of February 19, 2013; see earlier in this report.

⁸

The most important databases are:

- INES (the incident data base)
- IRS (the data base for malfunctions in nuclear power plants)
- IRSRR (the data base for malfunctions in research reactors)
- FINAS (the data base for facilities in the fuel cycle, among which uranium enrichment plants and storage locations for radioactive waste)

3 KFD analysis of Dutch events in 2013

In chapter 2 the events in 2013 in the various Dutch facilities are summed up. 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 safety problems?

For information, Table 1 gives an overview of the events from 2004 up till and including 2013, divided between Nuclear Power Plant Borssele (KCB) and the other Dutch nuclear facilities. Table 1 also contains an overview of all events with an INES level higher than 0, for KCB and the other Dutch nuclear facilities.

This information is shown graphically in Fig. 1.

Year	TOTAL			INES > 0		
	Total	KCB	Others	Total	KCB	Others
2013	16	4	12	7	1	6
2012	10	3	7	5	1	4
2011	14	8	6	3	3	0
2010	20	9	11	3	1	2
2009	13	3	10	1	0	1
2008	15	6	9	4	1	3
2007	15	5	10	2	1	1
2006	25	17	8	3	1	2
2005	23	13	10	4	2	2
2004	21	8	13	3	0	3

Table 1: The number of events of KCB and other nuclear facilities during the past ten years.

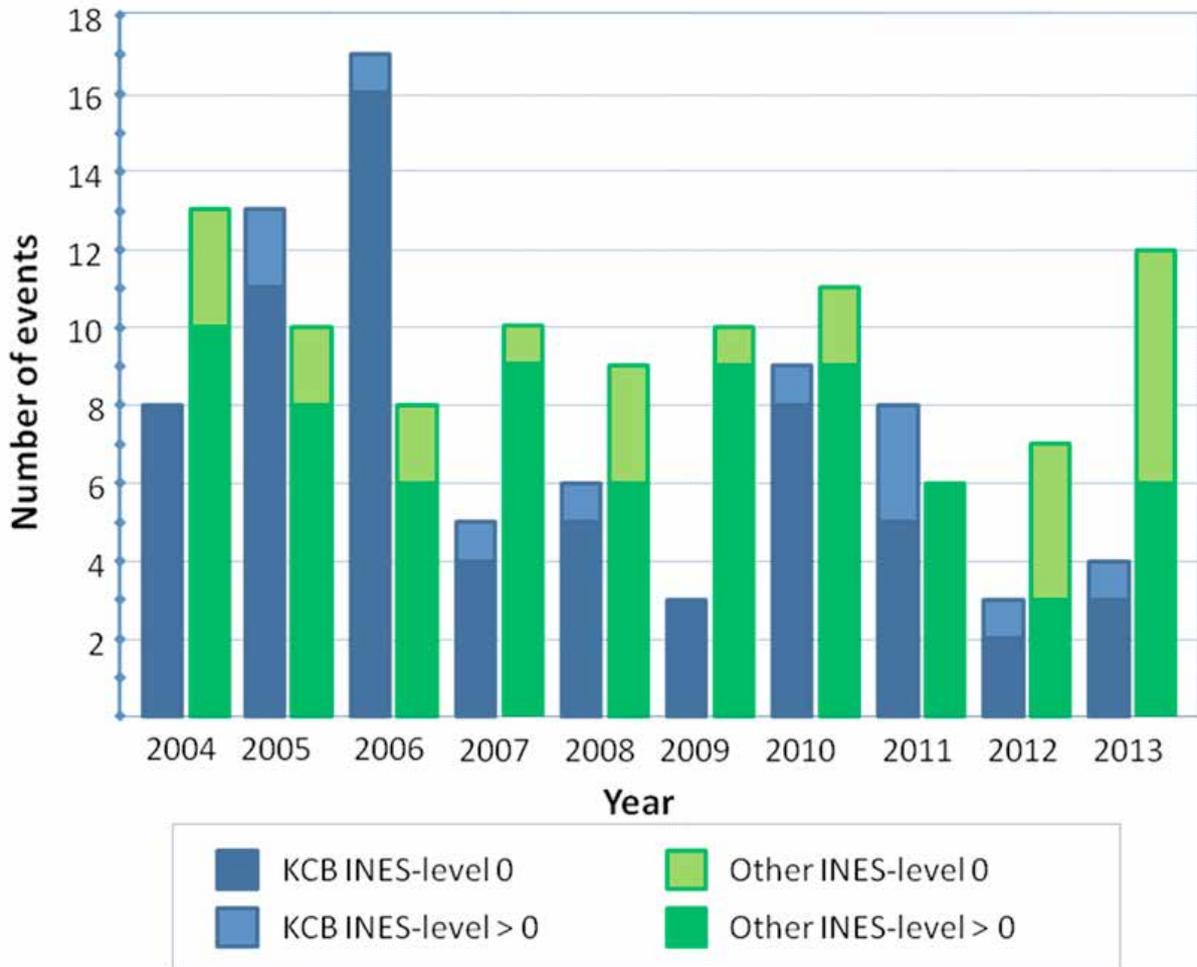


Figure 1: Graphic depiction of the number of events from 2004 to 2013 incl.

To the first question, how serious were these malfunctions, an answer can be given with the aid of the INES classifications given to them. Of the sixteen events recorded in 2013, nine are "relatively unimportant" (below-scale, INES level 0), four of some importance (INES level 1) and three of importance (INES level 2).

The occurrence of three INES 2 events in one year can be called exceptional. In the history of INES The Netherlands has made five INES 2 reports up to 2013. Four of these reports had reference to the finding of radioactive material in metal scrap and the fifth to an event in a nuclear facility.

When the INES scale was conceived in 1989, the criteria for the classification on the different levels were drawn up such that in a "normal" nuclear facility on the average about ten INES level 0 and one INES level 1 events could occur annually. An INES 2 event would occur once in ten year on the average.

The occurring of three INES 2 events can therefore justly be seen as an abnormality, the more so because all three events have occurred at the

same licensee, NRG. It has to be remarked that these events all three concerned a degradation of the safety barriers, without an actual addressing of these safety barriers. Therefore, the events had no actual consequences to man or environment.

The question whether the situation at the other nuclear facilities has become better or worse in 2013 than in preceding years and whether the other nuclear facilities perform better or worse than abroad, cannot be simply answered. This has the following reasons:

- The statistics of the data are meagre. There are (too) few events 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 international obligation to enter events into the INES system lies on minimum INES level 2. Consequently, for the INES levels 0 and 1 an objective numerical comparison with foreign countries is not possible.
- The reporting criteria always leave room for interpretations. This means that an increase in the number of reports by greater willingness to report could possibly be wrongly seen as a deterioration of the situation.

Taking this into account, the nature and the numbers of the reports at the other Dutch nuclear facilities in 2013 do not give a reason for questions about the safety situation in these facilities.

The question, whether the reported events are a signal of underlying safety problems, is discussed in more detail in the following two paragraphs. The first paragraph covers the situation at the Nuclear Power Plant Borssele and the second the other Dutch nuclear facilities.

3.1 Nuclear Power Plant Borssele

At KCB four events have occurred in 2013, one of which has been classified on INES level 1. The number of events in the last two years is low in comparison with preceding years. The relative severity of the events (the INES classification) does not deviate from that in preceding years. In the report over 2011 the occurrence of three events on INES level 1 drew the attention, but on the basis of the figures for 2012 and 2013 it can be concluded that this is an anomaly and not an indication for a deterioration of the safety situation.

KFD concludes on the basis of the available information that EPZ in general has carefully handled the events which occurred in 2013. The occurrences have been reported and analysed timely. The causes have been determined.

EPZ has been able to show that it makes efforts to learn from the events which have occurred and that it takes measures, where necessary, to prevent a recurrence.

KFD is of the opinion that EPZ in 2013 has sufficiently learned from the events to make the necessary improvement steps. 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

3.2.1 NRG

In 2013 eight events have been reported by NRG to KFD. Two of the reports of the HFR and the report of the MPF have been classified by KFD on INES level 2. Further, three reports of the HFR have been classified by KFD on INES level 1. As mentioned above, this is an exceptional situation. In 2013 the HFR has been in service during about three months (three cycles). The first months the facility was shut down because of an internal leakage which had been observed in November 2012. In June, 2013 the HFR was started up, but after three cycles the plant was shut down again because of the anomaly of the control rods described above. NRG has also shut down the MPF by the end of October as a precaution, conform to the request of KFD, because of the fact, described above, that it could not be excluded that a too high uranium concentration was present in a tank with liquid waste.

Also because of the situation in HFR and MPF, NRG has started in November, 2013 a "Return to Service" programme. This programme has amongst others as a purpose to enhance the reliability of the NRG plants. The programme started with the controlled ending of all activities in the plants managed by NRG. Then, NRG has implemented modifications in the technology, the safety system and the organisation. For this purpose NRG has appointed external experts which advise in the fields of organisation, safety culture, system analysis, ageing management and management system. In the first months of 2014 NRG has taken the plants into operation again. NRG has announced its intention not to slacken the intensified attention for the reliability of plants and operation, but to continue it in the "Return to Reliability" programme.

After evaluation of the measures and underlying analyses and on-site inspections KFD has issued a declaration of no objection for the restart of the plants, both for the HFR and the MPF.

KFD notices that NRG has meanwhile implemented serious improvements concerning the analysing and learning lessons of events. Not only the direct causes, but also the underlying causes are identified and tackled. Although the events occurring in 2013 have led KFD to further increase the frequency of the intensified surveillance, KFD also notices a serious reaction by NRG to the occurring of these events. In consecutive

programmes NRG has begun the execution of improvement measures which are active on all levels of the organisation. In that sense KFD therefore considers that, in spite of the occurring of a number of serious events in 2013, NRG is meanwhile learning sufficiently from the experiences obtained.

In 2012 KFD has placed NRG under intensified surveillance. The frequency of this intensified surveillance was further increased in October, 2013. This was expressed in a strongly aggravated inspection regime, an increase of the frequency of the management consultation meetings between NRG and KFD and a great effort by KFD in the follow-up of the events reported by NRG. As of May 21, 2014 KFD has reduced the frequency of the intensified surveillance to the surveillance level of prior to October, 2013. KFD has not yet left the regime of intensified surveillance, to ensure that NRG proceeds on the chosen road and continues to give high priority to the nuclear safety.

3.2.2 Other nuclear facilities

In 2013 four events have occurred at these other nuclear facilities. With respect to preceding years this is a normal picture. All these four events have been classified on INES level 0.

The events concerned are divided between two licensees, namely one event at Mallinckrodt Medical and three at URENCO.

The uncommon events have stimulated the companies to an analysis of the event. The direct and indirect causes have been mapped and, where necessary, measures have been taken to prevent the risk of recurrence in future.

KFD is of the opinion that the licensees concerned have effectively learned from the events to realise improvements. KFD continues to inform itself 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.

KFD concludes on the basis of the available information that the operators of the nuclear facilities have generally speaking carefully handled the events occurring in 2013 in their facilities.

Almost all events have been reported in time and well analysed. The causes have been determined.

The licensees have all been able to show that they make efforts to learn lessons from the events which have occurred and that they take measures where necessary to prevent a recurrence.

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 licence (and more specifically the Technical Specifications of a facility included in them) prescribes which events must be reported. The Dutch rules for reporting 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 on INES level 0, or "below scale".

The INES classification is the result of three separate classifications:

1. Escaped radiation or radioactive material,
2. Damage to man or environment,
3. Degradation of safety barriers.

The final classification of an incident is based on the highest classification of these three.

For the classification for escaped radiation and damage to man and environment the actual consequences are considered: how much material has entered the environment or how many persons have been exposed to which degree of radiation. For the classification for degradation of safety barriers no incident or accident needs to have occurred. In such a case the number of safety barriers protecting against an incident is relevant. The level of this classification is then determined by the number of barriers which are still present and the severity of the incident that could happen when the remaining barriers would also fail.

Consequently not all events which receive an INES classification have actual effects for man and environment.

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

- Level 1 is an anomaly or a malfunction. This concerns events during which e.g. the limits of the operating conditions are exceeded. Examples are an 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, or a small technical malfunction in a nuclear power plant, which has not caused the escape of radioactive material to the outside world.

- Level 2 is an incident. This concerns events by which an affection of the safety level occurs. 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 2013 and the preceding years in the Netherlands.

Events from INES level 2 and up are obligatory reported to the IAEA by the over 70 participating countries.

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 28, 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 into a stable phase and a reliable picture of the final consequences exists. 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

This document is a translation of Human Environment and Transport Inspectorate - KFD report "Rapportage ongewone gebeurtenissen in Nederlandse nucleaire inrichtingen in 2013".

In case of textual differences between the original report and this translation the original report is binding.

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Date

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