

The INES System, Nuclear Directorate (ND) Event Records and Descriptions of Events Notified to ND

Background Information

1. The International Nuclear and Radiological Event Scale (INES)

The Nuclear Installations Inspectorate (NII) requires all its licensees to comply with all the conditions attached to the Nuclear Site Licence and to operate in accordance with an adequate safety case. By doing so, a multi-barrier approach to preventing accidents (defence in depth) ensures licensee's nuclear operations are carried out in such a way that risks are reduced to levels as low as reasonably practicable (ALARP). This does not mean that incidents will not occur but rather that, where they do, sufficient safety barriers should remain in place to prevent an accident.

The International Nuclear and Radiological Event Scale (INES) is an international rating scale, developed by the International Atomic Energy Agency (IAEA), that is applied by nuclear licensees to incidents which occur on their particular sites. The IAEA states that the INES process:

"is used for promptly and consistently communicating to the public the safety significance of events associated with sources of radiation".

INES was designed as a rapid alert system, not a performance indicator or to indicate a level of investigation. It is therefore not appropriate to use INES to compare safety performance between facilities, organisations or countries. Arrangements for reporting minor events to the public may be different and it is difficult to ensure precise consistency in rating events at the boundary between Below Scale/Level 0 and Level 1. Although information will be available on events at Level 2 and above, the statistically small number of such events, which also varies from year to year, makes it difficult to make meaningful international comparisons.

The ratings cover a wide spectrum of practices including industrial use such as radiography, use of radiation sources in hospitals, activities at nuclear facilities, and the transport of radioactive material. By putting events from all these practices into a proper perspective, use of INES can facilitate a common understanding between the technical community, the media and the public.

- Level 0 events have no safety significance.
- Level 1 incidents are anomalies and address degradation of defence in depth.
- Levels 2 and 3 incidents cover more serious degradations of defence in depth or lower levels of "actual consequence" to people or facilities.
- Levels 4 to 7 accidents cover increasing levels of "actual consequence" to people, the environment or facilities.

Please see IAEA diagram overleaf to illustrate this more clearly.

Reduction in defence in depth principally covers those events with "no actual consequences", but where the measures put in place to prevent or cope with accidents did not operate as intended.



Diagram source: <http://www-ns.iaea.org/tech-areas/emergency/ines.htm>

Only 8 incidents are reported at INES Level 2 or above for the whole period covered by this disclosure and these are reviewed and verified by ND in accordance with its business arrangements at:

www.hse.gov.uk/foi/internalops/nsd/bmm/bmmanex5.pdf

Further information on the INES system may be found at:

<http://www-ns.iaea.org/tech-areas/emergency/ines.htm>.

2. Events in the UK

The overall numbers of INES events recorded reflect the following:

- That the UK is no different to anywhere else in the world in as much as where there is human activity there will always be a risk of incidents.
- The numbers of events reported to NII are a consequence of operating a complex nuclear installation. The reports reflect the openness and transparency of the licensees and the need for them to notify certain incidents in accordance with Licence Condition 7.
- In the UK, licensees and NII both work towards reducing the risk to levels that are as low as reasonably practicable (ALARP).
- Positive reporting culture is encouraged in the nuclear industry to learn lessons and reduce risk of recurrence.

- High numbers of near miss events and relatively low- level safety incidents are included in NII's screening process.
- In relation to challenges to safety cases the incidents are all relatively low level, as indicated by the low INES ratings. All are treated appropriately by both the licensee and NII in order to reduce the risk of recurrences.

The Information Provided

3. ND Event Records and INES Ratings

Licence Condition 7, attached to every Nuclear Site Licence, requires licensees to make and implement adequate arrangements to notify ND of certain incidents that occur on their respective sites (1). Licensees cooperate further with ND by reporting other events, which helps ND keep abreast of what is happening on their sites. As part of good practice, licensees are encouraged to put in place arrangements to learn the lessons from events and to share these within their own organisations (ie. other sites) and with other licensees, as appropriate.

Since 2001, ND has held electronic records of events that have been reported by our licensees under such arrangements and for which an inspector has raised a Fast Stream Report (2). As previously advised, it is from these records that we have sourced the information that you have requested.

Significantly, ND's interest in the event report lies not in its provisional INES rating - which in fact may not even be known at the time of the report and which may be revised when the full information is known - but in the safety significance of the event and its possible challenge to a nuclear safety system. Consequently, some of our records of events reported and summarised in our Fast Stream reports do not include an INES rating. Where we hold the updated rating, we have included the change but where this is not the case, or where the INES rating was not reported to us because it was unknown at the time, we have not tried to 'second guess' our licensees, and so these reports are not included in the information we have provided. However, it is important to note all of our Fast Stream Reports are screened for their safety significance and potential challenge to a nuclear safety system, in accordance with our documented processes (3), irrespective of whether or not they have been given an INES rating.

Outside ND's regulatory monitoring and enforcement processes, and in fulfilment of our duty to the public, we continue to place information into the public domain regarding the more significant incidents that occur on our licensees' sites. We do so through HSE's Quarterly Statements of Nuclear Incidents at Nuclear Installations, which cover those incidents that meet Ministerial reporting criteria (3). We also report such incidents and other events of a noteworthy nature to the relevant site Local Liaison Committees or Stakeholder Groups. Our reports are all available through our web site at <http://www.hse.gov.uk/nuclear/>.

On behalf of the Department of Energy and Climate Change (DECC), ND provides the UK INES National Officer (UKINO). The role is separate from the normal

regulatory functions of ND. Part of the UKINO role is to ensure that summary details of any event rated by an operator at INES level 2 or above, are posted promptly onto the International Atomic Energy Agency's INES website for wider dissemination. In addition the UKINO monitors incidents and events in the UK to review consistency of application of the INES scale

Outside the Fast Stream system, we hold other event records and where the necessary records exist electronically and are appropriately formatted, we have been able to source some additional information. However, it is the case that our systems for what are generally less significant events, are not as well developed as that for the Fast Stream system and consequently there is no equivalent, centrally coordinated system for storing such information and which can then be readily searched. These events are generally of less safety significance and are dealt with locally by the responsible operating division of ND and the relevant site inspector.

We are in the process of developing a process to capture all events centrally, including those reported under the Fast Stream system. At the moment there will be a relatively small number of events that occurred earlier than 2007, for which no Fast Stream report was raised and therefore this information has not been provided.

4. ND Event Descriptions

You requested short descriptions of the events and these have been grouped into one of seventeen categories (listed below), each of which is provided with an explanation and illustrative examples. As has already been explained in section 3 above, ND's records systems are in place for the benefit of our regulatory role, rather than for the purposes of INES itself. Were we to strictly adhere to the IAEA's user's manual on the INES system, then events and incidents in categories 1, 3, 4, and 10 below, would not be included in the lists of INES events that we are providing.

Each event in the accompanying pdf files has been assigned one of the seventeen descriptions. Please note that the descriptions assigned are based on the information to hand at the time that the event report was made and consequently they reflect limited, early information, which may have subsequently changed as the investigation of the circumstances proceeded. Also, it is quite possible for an event to fall into several different categories depending on the particular circumstances. Where this is the case, the most appropriate is used.

CATEGORY	<u>EVENT DESCRIPTION</u>
1	Administration matter
2	Automatic or manual reactor trip following plant anomaly
3	Conventional safety event
4	Environment event regulated by the Environment Agency or the Scottish Environment Protection Agency
5	External event

6	Flask or package movement or transport event
7	Unplanned leak or spillage of active or potentially active process liquor or material
8	Unplanned leak or spillage of contaminated or potentially contaminated coolant
9	Lifting event with nuclear safety implications
10	Media interest only
11	Non-adherence to a safety-related procedure
12	Non-compliance or inadequacy associated with arrangements made in the interests of safety
13	Non-compliance with conditions and limits necessary in the interests of safety
14	Radiation or contamination event affecting personnel
15	Safety-related plant defect or degradation
16	Safety-related plant requirement incorrectly implemented
17	Smouldering / smoking material or fire

1. Administration Matter: This description covers security matters and any re-categorisation of events that may have been initially reported either without an INES category or with one that has been subsequently revised in the light of a fuller understanding of the particular circumstances. It also includes circumstances which the licensee is continuing to investigate and which may prove to be an event that requires other notification in accordance with arrangements made under a condition attached to the Nuclear Site Licence.

2. Automatic or Manual Reactor Trip Following Plant Anomaly: As the description suggests, reactors may be tripped (shut down) either manually or automatically. The reasons for each trip can be quite complex and will depend on the particular circumstances, for example, because of plant breakdown or operating difficulties. For example, there may have been a failure of an associated item of equipment that has a 'knock-on' effect elsewhere in the control of the reactor. If the control systems fail to manage the situation and the safety systems monitoring the reactor conditions detect an anomaly of sufficient magnitude, then the latter will intervene to shut the reactor down before it can come to any harm. At other times, component plant failures or anomalies such as turbine faults or heat exchanger tube failures may be such that the licensee decides that there is a need to shut the reactor down for a repair and does so pre-emptively and irrespective of the safety systems being unperturbed by what has happened. A failure in the reactor protection system itself will also lead to a reactor trip, because of the fail-safe nature of the protection system. ND's interest in reactor trips lies in the fact that each one

places a demand on safety systems and auxiliary safety-related plant which normally does not see service while the reactor is at power but which keeps the reactor safe by providing alternative cooling to the nuclear fuel, as it is brought from being at power to being safely shut down.

3. Conventional Safety Event: This category of event includes those which are not associated with the working of the nuclear plant itself and which are regulated under the Health and Safety at Work etc Act 1974 and regulations made under the act such as the Ionising Radiations Regulations 1999 and the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR). Such events cover a wide range which includes serious personal injuries, the malfunction of breathing apparatus while in use, and the failure of lifting equipment. Where such failures also have the potential to compromise nuclear safety, they are included in category 9 rather than here in category 3. Category 3 also includes leaks of clean reactor gas (carbon dioxide) or leaks of clean coolant (usually water) from ancillary plant on a chemical plant or reactor, either of which may occur as a result of plant or operational failures. Also included in this category are matters associated with dosimetry (measurement and recording of personnel radiation dose) and radiography (use of sealed radioactive sources as a source of 'X-rays' for checking the integrity of welds and other plant components).

4. Environment Event Regulated by the Environment Agency or the Scottish Environment Protection Agency: Discharges of radioactive matter from, and movements of radioactive waste between or from Nuclear Licensed Sites are regulated by two government agencies through the issue of Authorisations under the Radioactive Substances Act 1993. In England and Wales, the agency is the Environment Agency and in Scotland it is the Scottish Environment Protection Agency. However, both agencies share with ND and HSE a common interest in waste management matters and the associated plant design, integrity and management. Accordingly, there is a Memorandum of Understanding between HSE and the agencies in question setting out their respective interests and which one will take the regulatory lead in common interest areas (4,5). Routine discharge authorisations may be breached as a result of operational problems or oversights as well as by plant failures and anomalies. It will be for the relevant agency to take the lead, which at some times will be ND and other times another regulator, depending on the particular circumstances.

Events which are directly or indirectly associated with discharge or transfer authorisations are included in this category. However, leaks from plant and other spillages, which may compromise compliance with a licence condition only, are categorised as being either a leak or spillage of active or potentially active process liquor or material (category 7), or one of potentially contaminated coolant (category 8). Where a leak or spillage affects both plant and personnel, the associated event is categorised as a radiation or contamination event affecting personnel (category 14).

5. External Event: Events in this category include seismic activity, adverse weather (wind and rain), and a low flying aircraft which may have breached the requirements of the Air Navigation (Restriction of Flying) (Nuclear Installations) Regulations. In the case of the latter, ND does not enforce the regulations but

nevertheless takes an interest in the matter because of the potential for safety margins to be eroded by such an event. Other events in this category are loss of power supplies from the grid and the loss of other external services such as computer services. Events in this category will all have been addressed in the safety case for the plant in question.

6. Flask or Package Movement or Transport Event: Events which involve flasks or other packages of radioactive matter which are being moved on a particular site or transported between two sites are included in this category. Once prepared, their transport off site and onto the receiving site is the responsibility of the Department for Transport with which ND has a Memorandum of Understanding (6). ND itself regulates the movement on site of other flasks and packages which do not leave site.

Despite being categorised as being transport events, it may be the case that the circumstances are identified during flask or package receipt on the receiving site, or during their maintenance on site. Examples are the identification of local surface contamination, incorrect torque settings applied to flask bolts, or incorrect accompanying paperwork. By its very nature, ND's Fast Stream Report system (2) attributes the event to the site which first discovers and then reports the anomaly. This is usually the site where the flask or package is received. However, this is not always the case, for example, where an issue is discovered while a flask or package is still in transit, in which case the site in question is likely to be the dispatching one.

7. Unplanned Leak or Spillage of active or Potentially Active Process Liquor or Material: This category of event includes leaks of process liquors or material from the primary containment of plants or reactors which are regulated under the Nuclear Installations Act 1965 (as amended). Such leaks may occur as a result of valves failing, the degradation of plant or pipework integrity, or from errors committed during operation or maintenance. The category also includes the identification of historical spills and minor leaks which have gone without notice and detection at the time they occurred. Leaks or spillages in this category will have arisen from circumstances which may have compromised the licensee's ability to comply with one or more of the conditions attached to the Nuclear Site Licence. Some may be of interest to the relevant environment agency, if the spill has escaped from secondary containment and possibly affected the environment.

8. Unplanned Leak or Spillage of Contaminated or Potentially Contaminated Coolant: The coolant in question may be carbon dioxide or water if a reactor vessel or its coolant system has leaked, or (normally) water if there has been a leak of coolant on a chemical plant. Some leaks are small but chronic and can continue unchecked until the evidence of their presence becomes sufficient for them to be identified. Others are the result of valve, pipework or process vessel anomalies which 'leak before break' to reveal a deficiency. Leaks of contaminated or potentially contaminated coolant normally involve very much less contamination than spillages or leaks of process material itself but may involve larger volumes. The category also includes the identification of historical spills and minor leaks which have gone without notice and detection at the time they occurred. The leak or spillage indicates circumstances which may have compromised the licensee's ability to comply with one or more of the conditions attached to the Nuclear Site Licence. As with leaks or

spillages of process liquors or material, the relevant environment agency may also have a regulatory interest in the occurrence, if the environment has been affected.

9. Lifting Event with Nuclear Safety Implications: Events in this category are a sub-set of those lifting events which in themselves are conventional in nature but which, because of their location or the particular item being lifted at the time, erode the safety margins of the nuclear plant within their vicinity. For example, the failure to normally lift and transfer a fuel element, whether or not the failure resulted in a dropped load, is viewed as a potential threat to the element's integrity, geometry or surface condition, any of which could affect nuclear safety. Likewise, a dropped or mishandled load adjacent to a nuclear safety-related item of plant may have the potential to compromise the plant's continued proper function or integrity.

10. Media Interest Only: NII has an operational need to keep abreast of safety-related and other events which occur on its nuclear licensed sites, including those which may attract media attention. Doing so helps inform our regulatory strategies and helps us maintain the capability of responding to any press enquiries, or queries from the public irrespective of the safety significance of the event. While our licensees are required to make arrangements to report certain safety-related events to us under one of the conditions attached to their Nuclear Site Licence, they also cooperate with us by alerting us to many matters which, while not affecting nuclear safety, nevertheless could be misconstrued to do so and consequently raise concern amongst the local community. Such events cover a wide range of topics but typically refer to an ambulance attending site to take to hospital a member of staff who may have been injured or taken ill. (Where such injury is known to be reportable under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR), the event is recorded under the conventional safety category, not as media interest only). Another example is where the fire brigade has attended site in response to a fire alarm which subsequently was established to be a false alarm. Events involving actual fires or smouldering material are included in category 17. Other events in this media interest only category are a train breakdown or event that has occurred while a fuel flask associated with the site in question was being transported by the train but which was itself unaffected by the event. Likewise, any call-out of site staff under Radsafe is also included (Radsafe is a consortium of organisations that offers mutual assistance in the event of a transport accident involving radioactive materials belonging to a Radsafe member such as British Energy or Sellafield Ltd.).

11. Non-adherence to a Safety Related Procedure: All activities on a Nuclear Licensed Site are undertaken in accordance with suites of procedures and arrangements to ensure continued safety throughout the lifetime of the plant or reactor from its design through to its maintenance, operation and eventual decommissioning. Such a procedure may, for example, cover the raising of work permits in order to control maintenance on a safety-related item of plant. Another example would be entering a record and signature in a particular control room log sheet. Some log sheets form part of the management process to monitor at all times the exact condition of the plant or process. Such sheets ensure future operational decisions, which may alter the plant condition, do not compromise its continued safe operation through their being taken without an accurate understanding of the plant's current condition.

12. Non-compliance or Inadequacy Associated with Arrangements made in the interests of Safety: Such arrangements address all aspects of a licensee's nuclear safety-related work and are required to be adequate by the conditions attached to the Nuclear Site Licence. When non-compliances are identified or other inadequacies are revealed by events that have occurred, it may be the case that a licensee has compromised not just their ability to comply with one or more of the conditions but also the safety margins built into the safety case. Events included in this category cover a wide spectrum. Examples would be the compromising of a seismic safety case by leaving loose scaffolding poles and other equipment in the plant area concerned, failures to implement modification procedures in part or in their entirety, the identification during operation of an adverse component specification change made by a manufacturer, and failures to complete maintenance in accordance with the plant maintenance schedule. Events in this category may be viewed as technical breaches of licence conditions which have not resulted in actual harm

13. Non-compliance with Conditions and Limits Necessary in the interests of Safety: Licensees are required by a condition attached to the Nuclear Site Licence to produce an adequate safety case and to identify the conditions and limits necessary in the interests of safety. Such conditions and limits cover the whole spectrum of safety significance. The more important ones are called different names by different licensees, such as Operating Rules, Technical Specifications, Identified Operating Instructions, Key Safety Related Equipment or Key Safety Management Requirement. Subordinate limits and conditions are also set below the more important ones to achieve the necessary safety margins declared in the safety case.

A very wide range of plant and parameters are included in such limits and conditions of which the following list gives an indication: safety system condition and availability; plant availability; valve configurations; temperature, pressure and flow rate trip settings; neutron flux densities; commodity availability; instrumentation accuracy and availability. Through the safety case process, the identified plant and parameter conditions and limits together form a series of safety barriers in a multi-barrier approach to achieve defence in depth. This means that when a condition or limit is breached, there should be sufficient safety barriers remaining operational to prevent an accident. Nevertheless, barriers do get breached as a result of incorrectly setting up, calibrating or configuring plant and equipment, as well as by plant failures or incorrect operation, and such events are recorded in this category.

14. Radiation or Contamination Event Affecting Personnel: Events in this category are related to those in categories 7 and 8 but involve personnel contamination or radiation exposure. The category here includes those events where personnel were evacuated as a precaution following a contamination or radiation alarm which was not a false alarm. Also included are instances where personnel received significant unplanned radiation doses or potential internal doses from inhalation. Other events include those where personnel were contaminated with radioactive material but which was subsequently removed upon its discovery. Such contamination could have arisen, for example from a plant containment degradation or failure, or from either a shortcoming in plant or job preparation prior to maintenance or methodology during maintenance.

15. Safety-related Plant Defect or Degradation: Despite undertaking routine preventative maintenance in accordance with maintenance schedules, the performance of safety-related plant may still degrade or fail in service. This may be due to simple wear out or an error in previously undertaken maintenance. Whatever the cause, it manifests itself in a structural or behavioural plant failure. While such failures may point to areas for improvement in the maintenance schedule or perhaps the design of the component, they may also represent challenges to safety case assumptions or margins of safety. Examples are a failure of pipe supports through corrosion, the cracking of a graphite brick in a reactor, the failure of a grab to unlock and release its load, the cracking of glass comprising the shielding window of a shielded facility and changes in metal ductility. Failures of pipework and vessels containing process material, liquors or coolant are included in categories 7 and 8.

16. Safety-related Plant Requirement incorrectly implemented: Events included in this category are of lesser safety significance than those relating to non-compliance with conditions and limits necessary in the interests of safety (category 13). It is important that the plant status is known in order to accurately and consistently predict plant system behaviour. Incorrectly set up safety-related plant and equipment may compromise safety case assumptions and margins of safety if plant fails to act or to be operationally available, as expected. Examples here are inadvertent isolation of safety-related equipment through incorrectly configuring valves, working on the wrong piece of equipment, isolating the wrong piece of equipment for maintenance, or failing to correctly reinstate equipment following maintenance work.

17. Smouldering / Smoking Material or Fire: Included in this category are any events where ignition of material has taken place on the Nuclear Licensed Site or instances of smouldering there where such ignition could not reasonably be ruled out, given the information available at the time. Examples of such events are welding 'spatter', which, despite taking precautions, inadvertently comes into contact with flammable material or liquid. Rotating plant such as pumps and turbines, have grease-packed bearings which, on occasion, may overheat and ignite if the bearing fails. The inadvertent contact of leaking lubricating oils with other hot, lagged surfaces may also lead to occasions where smoke is generated. There have also been a number of false alarms, particularly on reactor sites, and these are included under category 10, media interest only.

References

1. Nuclear Site licence Conditions: <http://www.hse.gov.uk/nuclear/silicon.pdf>
2. ND Fast Stream Report Process: <http://www.hse.gov.uk/foi/internalops/nsd/inspection/ins011.pdf>
3. ND Incident Screening Process: <http://www.hse.gov.uk/foi/internalops/nsd/bmm/bmmanex8.htm>
4. Memorandum of Understanding between HSE and EA <http://www.hse.gov.uk/nuclear/nucmou.pdf>
5. Memorandum of Understanding between HSE and SEPA <http://www.hse.gov.uk/aboutus/howwework/framework/mou/sepa-nuclear.pdf>

6. Memorandum of Understanding between HSE and DfT
<http://www.hse.gov.uk/aboutus/howwework/framework/mou/cdg-dft.pdf>