



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
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July 13, 2009

ALL AGREEMENT STATES AND NON-AGREEMENT STATES

REVISED INTERNATIONAL NUCLEAR EVENT SCALE (INES) USER'S MANUAL  
(FSME-09-052)

**Purpose:** In our March 1, 2002 and September 7, 2004 All Agreement States Letters ([STP-02-018](#) and [STP-04-064](#), respectively), we provided information related to the United States Nuclear Regulatory Commission (NRC) participation in the International Atomic Energy Agency's (IAEA) International Nuclear Event Scale (INES). INES is used for promptly and consistently communicating to the public the safety significance of incident and events associated with sources of radiation. It covers 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 different practices into a proper perspective, use of INES can facilitate a common understanding between the technical community, the media and the public.

**Background:** Initially, the scale was applied to classify events at nuclear power plants, and then was extended and adapted to enable it to be applied to all installations associated with the civil nuclear industry. The STP-04-064 letter described a pilot program that was initiated worldwide in 2004 to expand the use of INES to include the rating of transport and radiation source events. The pilot's successful use of the draft guidance from 2004-2007 allowed the IAEA and its INES Advisory Committee to obtain feedback on the rating of such events and to provide insights for a full revision of the 2002 INES User's Manual. As a result of these efforts, a new revised INES User's Manual was later developed and approved by the 63 member countries that use INES in July 2008. This new User's Manual (recently posted in June 2009 on IAEA's website at <http://www-pub.iaea.org/MTCD/publications/PubDetails.asp?pubId=8120>) incorporates the radiation source pilot initiatives and allows for the communication of the safety significance of all events associated with the transport, storage and use of radioactive material and radiation sources.

Since the initiation of the pilot program in 2004, both NRC and the Agreement States have been using a very similar version of this manual to rate the safety significance of events at INES Level 2 or above and report them to the IAEA. Events are considered in terms of their impact on three different areas: impact on people and the environment; impact on radiological barriers and controls at facilities; and impact on defense in depth. Further information and additional technical details can be found in the 2008 INES User's Manual.

**Discussion:** The process for NRC notification to IAEA of the occurrence of a radioactive material event that meets the INES event rating criteria is as follows:

1. Use the new, revised INES User's Manual (2008 Edition);
2. Continue the INES notification schedule of two business days to IAEA;

3. The notification schedule of two business days begins when either the Event Notification (EN) is submitted to the NRC Operations Center or the NRC has sufficient information for an event which is potentially INES reportable. For the latter, the NRC typically issues a Preliminary Notification (PN) for the event;
4. Provide the Agreement States an opportunity to concurrently review and concur on the INES Rating Form in parallel with NRC internal review. If comments are not received, or the State is unable to comment, the *provisional* INES event rating form will be sent by NRC to IAEA within two business days;
5. For material events at INES Level 2 and above that are not materials regulated by NRC (e.g., x-rays), the NRC (through the INES National Officer) will submit an INES event to the IAEA if a state voluntarily provides a draft ERF outlining the event.
6. Attached are an International Nuclear and Radiological Event leaflet and an INES Event Rating Form (ERF). Please use the blank ERF to provide us with as much information as possible and send it to us in accordance with the above criteria.

NOTE: The original INES notification contains a *provisional* rating that is typically finalized in the future based on the final results of an investigation or assessment of the event.

If you have any questions, please contact me at (301) 415-3340 or the individual named below.

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***/RA/***

Robert J. Lewis, Director  
Division of Materials Safety and  
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Enclosure:

1. The International Nuclear and Radiological Event Scale chart
2. INES Event Rating Form

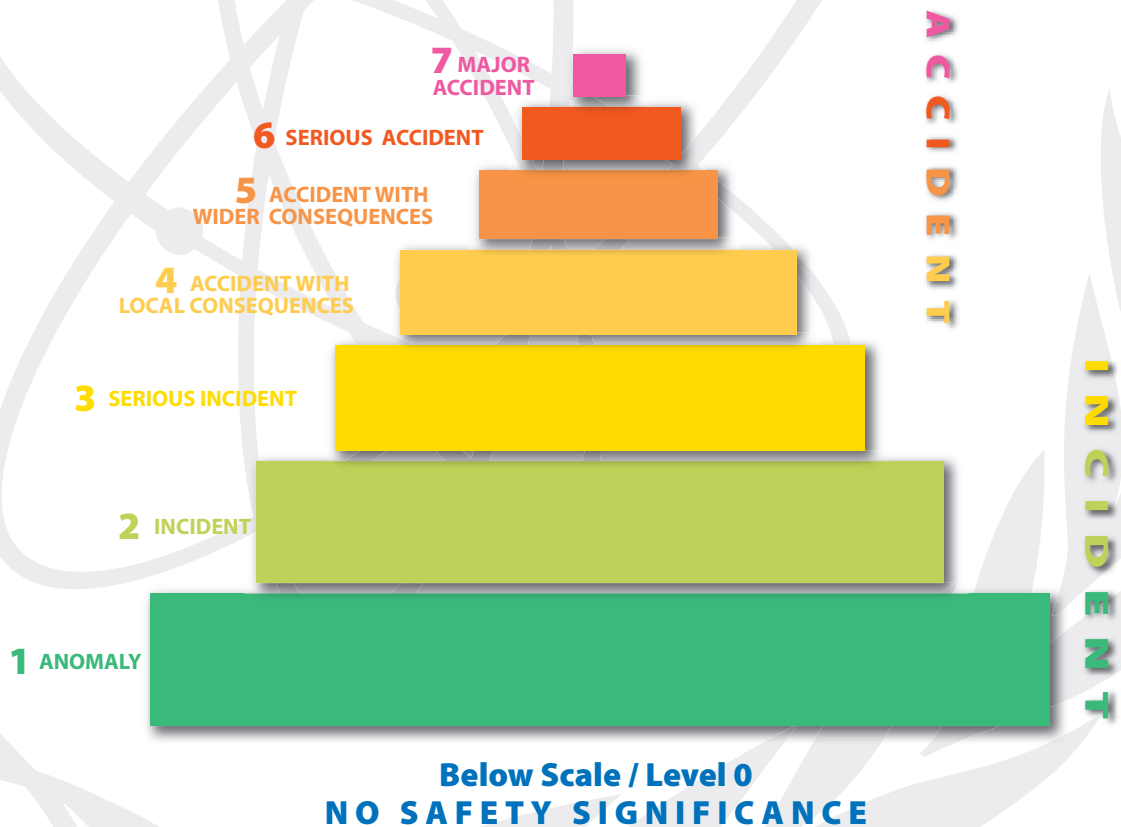
# INES

## THE INTERNATIONAL NUCLEAR AND RADIOLOGICAL EVENT SCALE

The INES Scale is a worldwide tool for communicating to the public in a consistent way the safety significance of nuclear and radiological events.

Just like information on earthquakes or temperature would be difficult to understand without the Richter or Celsius scales, the INES Scale explains the significance of events from a range of activities, including industrial and medical use of radiation sources, operations at nuclear facilities and transport of radioactive material.

Events are classified on the scale at seven levels: Levels 1–3 are called "incidents" and Levels 4–7 "accidents". The scale is designed so that the severity of an event is about ten times greater for each increase in level on the scale. Events without safety significance are called "deviations" and are classified Below Scale / Level 0.



**IAEA**  
International Atomic Energy Agency  
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Nuclear Energy Agency

For more information: [www-news.iaea.org](http://www-news.iaea.org)



Major Accident Level 7
Serious Accident Level 6
Accident with Wider Consequences Level 5
Accident with Local Consequences Level 4
Serious Incident Level 3
Incident Level 2
Anomaly Level 1
NO SAFETY SIGNIFICANCE (Below Scale/ Level 0)

**INES** classifies nuclear and radiological accidents and incidents by considering three areas of impact:

**People and the Environment** considers the radiation doses to people close to the location of the event and the widespread, unplanned release of radioactive material from an installation.

**Radiological Barriers and Control** covers events without any direct impact on people or the environment and only applies inside major facilities. It covers unplanned high radiation levels and spread of significant quantities of radioactive materials confined within the installation.

**Defence-in-Depth** also covers events without any direct impact on people or the environment, but for which the range of measures put in place to prevent accidents did not function as intended.

### Communicating Events

Nuclear and radiological events are promptly communicated by the INES Member States, otherwise a confused understanding of the

event may occur from media or from public speculation. In some situations, where not all the details of the event are known early on, a provisional rating may be issued. Later, a final rating is determined and any differences explained.

To facilitate international communications for events attracting wider interest, the IAEA maintains a web-based communications network that allows details of the event to immediately be made publicly available.

The two tables that follow show selected examples of historic events rated using the INES scale, ranging from a Level 1 anomaly to a Level 7 major accident; a much wider range of examples showing the rating methodology is provided in the INES Manual.

### Scope of the Scale

**INES** applies to any event associated with the transport, storage and use of radioactive material and radiation sources, whether or not the event occurs at a facility. It covers a wide spectrum of practices, including industrial use

## EXAMPLES OF EVENTS AT NUCLEAR FACILITIES

	People and Environment	Radiological Barriers and Control	Defence-in-Depth
7	<i>Chernobyl, 1986</i> — Widespread health and environmental effects. External release of a significant fraction of reactor core inventory.		
6	<i>Kyshtym, Russia, 1957</i> — Significant release of radioactive material to the environment from explosion of a high activity waste tank.		
5	<i>Windscale Pile, UK, 1957</i> — Release of radioactive material to the environment following a fire in a reactor core.	<i>Three Mile Island, USA, 1979</i> — Severe damage to the reactor core.	
4	<i>Tokaimura, Japan, 1999</i> — Fatal overexposures of workers following a criticality event at a nuclear facility.	<i>Saint Laurent des Eaux, France, 1980</i> — Melting of one channel of fuel in the reactor with no release outside the site.	
3	<i>No example available</i>	<i>Sellafield, UK, 2005</i> — Release of large quantity of radioactive material, contained within the installation.	<i>Vandelllos, Spain, 1989</i> — Near accident caused by fire resulting in loss of safety systems at the nuclear power station.
2	<i>Atucha, Argentina, 2005</i> — Overexposure of a worker at a power reactor exceeding the annual limit.	<i>Cadarache, France, 1993</i> — Spread of contamination to an area not expected by design.	<i>Forsmark, Sweden, 2006</i> — Degraded safety functions for common cause failure in the emergency power supply system at nuclear power plant.
1			Breach of operating limits at a nuclear facility.

## EXAMPLES OF EVENTS INVOLVING RADIATION SOURCE AND TRANSPORT

	People and Environment	Defence-in-Depth
7		
6		
5	<i>Goiânia, Brazil, 1987</i> — Four people died and six received doses of a few Gy from an abandoned and ruptured highly radioactive Cs-137 source.	
4	<i>Fleurus, Belgium, 2006</i> — Severe health effects for a worker at a commercial irradiation facility as a result of high doses of radiation.	
3	<i>Yanango, Peru, 1999</i> — Incident with radiography source resulting in severe radiation burns.	<i>Ikitelli, Turkey, 1999</i> — Loss of a highly radioactive Co-60 source.
2	<i>USA, 2005</i> — Overexposure of a radiographer exceeding the annual limit for radiation workers.	<i>France, 1995</i> — Failure of access controls systems at accelerator facility.
1		Theft of a moisture-density gauge.

such as radiography, use of radiation sources in hospitals, activity at nuclear facilities, and transport of radioactive material.

It also includes the loss or theft of radioactive sources or packages and the discovery of orphan sources, such as sources inadvertently transferred into the scrap metal trade.

When a device is used for medical purposes (e.g., radiodiagnosis or radiotherapy), INES is used for the rating of events resulting in actual exposure of workers and the public, or involving degradation of the device or deficiencies in the safety provisions. Currently, the scale does not cover the actual or potential consequences for patients exposed as part of a medical procedure.

The scale is only intended for use in civil (non-military) applications and only relates to the safety aspects of an event. INES is not intended for use in rating security-related events or malicious acts to deliberately expose people to radiation.

### What the Scale is Not For

It is not appropriate to use INES to compare safety performance between facilities,

organizations or countries. The statistically small numbers of events at Level 2 and above and the differences between countries for reporting more minor events to the public make it inappropriate to draw international comparisons.

### History

Since 1990 the scale has been applied to classify events at nuclear power plants, then extended to enable it to be applied to all installations associated with the civil nuclear industry. By 2006, it had been adapted to meet the growing need for communication of the significance of all events associated with the transport, storage and use of radioactive material and radiation sources.

The IAEA has coordinated its development in cooperation with the OECD/NEA and with the support of more than 60 Member States through their officially designated INES National Officers.

The current version of the INES manual was adopted 1 July 2008. With this new edition, it is anticipated that INES will be widely used by the Members States and become the world-wide scale for putting into the proper perspective the safety significance of nuclear and radiation events.

# INES

THE INTERNATIONAL NUCLEAR AND RADIOLOGICAL EVENT SCALE

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### GENERAL DESCRIPTION OF INES LEVELS

INES Level	People and Environment	Radiological Barriers and Control	Defence-in-Depth
<b>Major Accident Level 7</b>	<ul style="list-style-type: none"> <li>Major release of radioactive material with widespread health and environmental effects requiring implementation of planned and extended countermeasures.</li> </ul>		
<b>Serious Accident Level 6</b>	<ul style="list-style-type: none"> <li>Significant release of radioactive material likely to require implementation of planned countermeasures.</li> </ul>		
<b>Accident with Wider Consequences Level 5</b>	<ul style="list-style-type: none"> <li>Limited release of radioactive material likely to require implementation of some planned countermeasures.</li> <li>Several deaths from radiation.</li> </ul>	<ul style="list-style-type: none"> <li>Severe damage to reactor core.</li> <li>Release of large quantities of radioactive material within an installation with a high probability of significant public exposure. This could arise from a major criticality accident or fire.</li> </ul>	
<b>Accident with Local Consequences Level 4</b>	<ul style="list-style-type: none"> <li>Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls.</li> <li>At least one death from radiation.</li> </ul>	<ul style="list-style-type: none"> <li>Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory.</li> <li>Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.</li> </ul>	
<b>Serious Incident Level 3</b>	<ul style="list-style-type: none"> <li>Exposure in excess of ten times the statutory annual limit for workers.</li> <li>Non-lethal deterministic health effect (e.g., burns) from radiation.</li> </ul>	<ul style="list-style-type: none"> <li>Exposure rates of more than 1 Sv/hr in an operating area.</li> <li>Severe contamination in an area not expected by design, with a low probability of significant public exposure.</li> </ul>	<ul style="list-style-type: none"> <li>Near accident at a nuclear power plant with no safety provisions remaining.</li> <li>Lost or stolen highly radioactive sealed source.</li> <li>Misdelivered highly radioactive sealed source without adequate procedures in place to handle it.</li> </ul>
<b>Incident Level 2</b>	<ul style="list-style-type: none"> <li>Exposure of a member of the public in excess of 10 mSv.</li> <li>Exposure of a worker in excess of the statutory annual limits.</li> </ul>	<ul style="list-style-type: none"> <li>Radiation levels in an operating area of more than 50 mSv/hr.</li> <li>Significant contamination within the facility into an area not expected by design.</li> </ul>	<ul style="list-style-type: none"> <li>Significant failures in safety provisions but with no actual consequences.</li> <li>Found highly radioactive sealed orphan source, device or transport package with safety provisions intact.</li> <li>Inadequate packaging of a highly radioactive sealed source.</li> </ul>
<b>Anomaly Level 1</b>			<ul style="list-style-type: none"> <li>Overexposure of a member of the public in excess of statutory annual limits.</li> <li>Minor problems with safety components with significant defence-in-depth remaining.</li> <li>Low activity lost or stolen radioactive source, device or transport package.</li> </ul>

NO SAFETY SIGNIFICANCE (*Below Scale/Level 0*)

**EVENT RATING FORM (ERF)**

Event No.:

Sent Date:

<b>THE INTERNATIONAL NUCLEAR EVENT SCALE (INES)</b>												
EVENT TITLE										EVENT DATE		
RATING	RATING DATE	OUT OF SCALE	DEVIATION	INCIDENT			ACCIDENT				FACILITY TYPE	
PROVISIONAL <input type="checkbox"/>			0	1	2	3	4	5	6	7	Power Reactor <input type="checkbox"/>	Research Reactor <input type="checkbox"/>
FINAL <input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	RadWaste Facility <input type="checkbox"/>	Radiation Source <input type="checkbox"/>
COUNTRY			FACILITY NAME / PLACE								Irradiation <input type="checkbox"/>	Transportation <input type="checkbox"/>
											Fuel Fabrication <input type="checkbox"/>	Fuel Reprocessing <input type="checkbox"/>
											Research Facility <input type="checkbox"/>	Mining/Milling <input type="checkbox"/>
											Enrichment Facility <input type="checkbox"/>	Other <input type="checkbox"/>
											<b>YES</b>	<b>NO</b>
<b>Off-site impact</b>												
Release Beyond Authorised Limits											<input type="checkbox"/>	<input type="checkbox"/>
Overexposure of Members of Public											<input type="checkbox"/>	<input type="checkbox"/>
<b>On-Site Impact</b>												
Contamination Spread											<input type="checkbox"/>	<input type="checkbox"/>
Worker Overexposure											<input type="checkbox"/>	<input type="checkbox"/>
Damage to Radiological Barriers											<input type="checkbox"/>	<input type="checkbox"/>
Degradation of Defence In-depth											<input type="checkbox"/>	<input type="checkbox"/>
Person Injured Physically or Casualty											<input type="checkbox"/>	<input type="checkbox"/>
Is There a Continuing Problem											<input type="checkbox"/>	<input type="checkbox"/>
Press Release Issued (if yes, please attach)											<input type="checkbox"/>	<input type="checkbox"/>
<b>Event Description</b>												
<b>Rating Justification and Difficulties Encountered</b> (quote relevant user manual paragraphs)												
<b>Contact Person for Further Information</b>												
<b>Name</b> Dr. Cynthia Jones, Office of Nuclear Security and Incident Response								<b>Affiliation</b> U.S. Nuclear Regulatory Commission				
<b>Address:</b> Mail Stop T4-D22A, Washington, DC 20555												
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**NOTE:** This form *should not* be used for sending information to the IAEA about an actual event!  
For this purpose the Nuclear Events Web-based System (<http://www-news.iaea.org>) should be used instead.