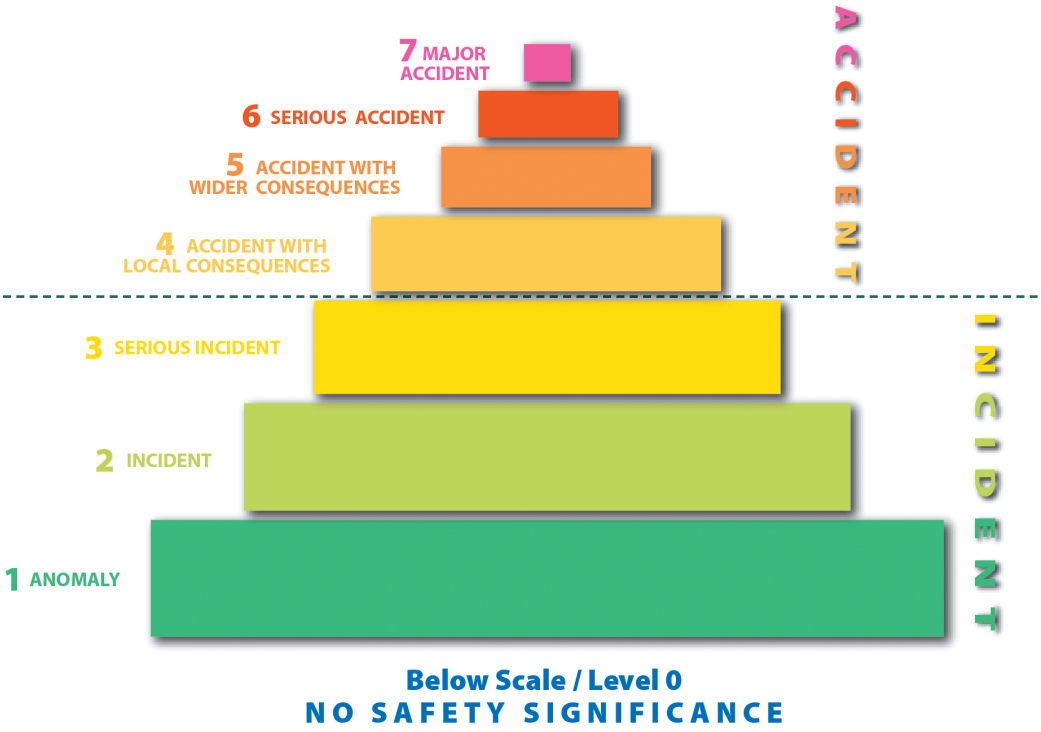
INES

The International Nuclear and Radiological Event Scale

User's Manual

2008 Edition



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The procedure for applying these criteria is summarized in the flowcharts in Section 7. However, it should be noted that for events associated with transport and radiation sources, it is only necessary to consider the criteria for doses to individuals when there is a significant release of radioactive material.

2.2. ACTIVITY RELEASED

The highest four levels on the scale (Levels 4–7) include a definition in terms of the quantity of activity released, defining its size by its radiological equivalence to a given number of terabecquerels of ^{131}I. (The method for assessing radiological equivalence is given in Section 2.2.1). The choice of this isotope is somewhat arbitrary. It was used because the scale was originally developed for nuclear power plants and ^{131}I would generally be one of the more significant isotopes released.

The reason for using quantity released rather than assessed dose is that for these larger releases, the actual dose received will very much depend on the protective action implemented and other environmental conditions. If the protective actions are successful, the doses received will not increase in proportion to the amount released.

2.2.1. Methods for assessing releases

Two methods are given for assessing the radiological significance of a release, depending on the origin of the release and hence the most appropriate assumptions for assessing the equivalence of releases. If there is an atmospheric release from a nuclear facility, such as a reactor or fuel cycle facility, Table 2 gives conversion factors for radiological equivalence to ^{131}I that should be used. The actual activity of the isotope released should be multiplied by the factor given in Table 2 and then compared with the values given in the definition of each level. If several isotopes are released, the equivalent value for each should be calculated and then summed (see examples 5–7). The derivation of these factors is explained in Appendix I.

If the release occurs during the transport of radioactive material or from the use of radiation sources, D_2 values should be used. The D values are a level of activity above which a source is considered to be ‘dangerous’ and has a significant potential to cause severe deterministic effects if not managed safely and securely. The D_2 value is “the activity of a radionuclide in a source that, if uncontrolled and dispersed, might result in an emergency that could reasonably be expected to cause severe deterministic health effects” [5]. Appendix III lists D_2 values for a range of isotopes.

TABLE 2. RADIOLOGICAL EQUIVALENCE TO ^{131}I FOR RELEASES TO THE ATMOSPHERE

Isotope	Multiplication factor
Am-241	8 000
Co-60	50
Cs-134	3
Cs-137	40
H-3	0.02
I-131	1
Ir-192	2
Mn-54	4
Mo-99	0.08
P-32	0.2
Pu-239	10 000
Ru-106	6
Sr-90	20
Te-132	0.3
U-235(S)[a]	1 000
U-235(M)[a]	600
U-235(F)[a]	500
U-238(S)[a]	900
U-238(M)[a]	600
U-238(F)[a]	400
U nat	1 000
Noble gases	Negligible (effectively 0)

[a] Lung absorption types: S — slow; M — medium; F — fast. If unsure, use the most conservative value.

For events involving releases that do not become airborne (e.g. aquatic releases or ground contamination due to spillage of radioactive material), the rating based on dose should be established, using Section 2.3. Liquid discharges resulting in doses significantly higher than that appropriate for Level 3 would need to be rated at Level 4 or above, but the assessment of radiological equivalence would be site specific, and therefore detailed guidance cannot be provided here.

2.2.2. Definition of levels based on activity released[2]

Level 7

"*An event resulting in an environmental release corresponding to a quantity of radioactivity radiologically equivalent to a release to the atmosphere of more than several tens of thousands of terabecquerels of* ^{131}I."

This corresponds to a large fraction of the core inventory of a power reactor, typically involving a mixture of short and long lived radionuclides. With such a release, stochastic health effects over a wide area, perhaps involving more than one country, are expected, and there is a possibility of deterministic health effects. Long-term environmental consequences are also likely, and it is very likely that protective action such as sheltering and evacuation will be judged necessary to prevent or limit health effects on members of the public.

Level 6

"*An event resulting in an environmental release corresponding to a quantity of radioactivity radiologically equivalent to a release to the atmosphere of the order of thousands to tens of thousands of terabecquerels of* ^{131}I."

With such a release, it is very likely that protective action such as sheltering and evacuation will be judged necessary to prevent or limit health effects on members of the public.

Level 5

"An event resulting in an environmental release corresponding to a quantity of radioactivity radiologically equivalent to a release to the atmosphere of the order of hundreds to thousands of terabecquerels of ^{131}I*."*

or

[2] These criteria relate to accidents where early estimates of the size of release can only be approximate. For this reason, it is inappropriate to use precise numerical values in the definitions of the levels. However, in order to help ensure consistent interpretation of these criteria internationally, it is suggested that the boundaries between the levels are about 500, 5000 and 50 000 TBq ^{131}I.