

FACT SHEET

Safety Standards of the International Atomic Energy Agency

(as at 5 December 2011)

1. Background

1.1 This fact sheet provides Members of the Panel on Security with information on the Safety Standards of the International Atomic Energy Agency ("IAEA") on nuclear safety. It also highlights the Action Plan on Nuclear Safety endorsed at IAEA's General Conference held in September 2011 that covers, among other things, nuclear safety, emergency preparedness and response, radiation protection of people and the environment, and the relevant international legal framework.

2. International Atomic Energy Agency

2.1 Established in 1957, IAEA is the world's centre of cooperation in the nuclear field. IAEA is an independent international organization under the aegis of the United Nations, tasked with limiting the military use of nuclear energy and promoting its use for peaceful purposes. Its relationship with the United Nations is governed by a special agreement, as well as by its statute that commits IAEA to report annually to the General Assembly of the United Nations.

2.2 The IAEA Secretariat is headquartered in Vienna of Austria. Yukiya AMANO is the Director General of IAEA, assisted by six Deputy Directors General for the major departments. The Secretariat also has 2 300 multi-disciplinary professional and support staff from more than 100 countries.

2.3 IAEA works with its 151 Member States and multiple partners worldwide to promote safe, secure and peaceful nuclear technologies. The three major areas of work of IAEA are safety and security, science and technology as well as safeguards and verification. In addition, IAEA plays a central role in strengthening the global nuclear safety framework and issues the IAEA Safety Standards as the common reference for nuclear safety in the world¹.

3. International Atomic Energy Agency's Safety Standards

3.1 After the Chernobyl nuclear accident in 1986, the globally recognized IAEA Safety Standards have been further developed and adopted worldwide. The IAEA Safety Standards reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from the harmful effects of ionizing radiation.

3.2 IAEA's Safety Standards, featuring a series of publication classified under the Safety Fundamentals, the General Safety Requirements and the General Safety Guides, are applicable to all facilities and activities². "Safety" as used in the IAEA Safety Standards covers the safety of nuclear installations, radiation safety, the safety of radioactive waste management and safety in the transport of radioactive material. Safety is concerned with both radiation risks under normal circumstances and as a consequence of incidents.

3.3 The Safety Fundamentals set out the basic objectives, concepts and principles of safety and protection in the development and application of nuclear energy for peaceful purposes. It also formulates 10 associated safety principles to achieve the fundamental safety objective of protecting people and the environment from harmful effects of ionizing radiation³.

¹ IAEA also co-operates with other international organizations, such as the Food and Agriculture Organization of the United Nations and the World Health Organization, on the food safety issues.

² Facilities and activities refer to those give rise to radiation risks, including nuclear installations and uses of radiation and radioactive sources, the transport of radioactive material and the management of radioactive waste.

³ For example, protection must be optimized to provide the highest level of safety that can be achieved. In addition, people and the environment, present and future, must be protected against radiation risks.

3.4 The General Safety Requirements stipulates the requirements that must be met to ensure the protection of people and environment, both now and in the future, against radiation risks. Meanwhile, the General Safety Guides recommend actions, conditions or procedures for meeting the safety requirements. In March 2002, IAEA's Board of Governors approved a General Safety Requirements document, *Preparedness and Response for a Nuclear or Radiological Emergency*, to establish the requirements for an adequate level of preparedness and response for a nuclear or radiological emergency in any Member State. In 2007, a General Safety Guides document, *Arrangements for Preparedness for a Nuclear or Radiological Emergency* was developed to assist IAEA's Member States in the preparation for a nuclear or radiological emergency.

3.5 In the event of an accident, radioactive material released into the environment is no longer under control and doses⁴ can only be reduced through protective actions. Since protective actions may impose constraints on people's activities and incur additional risks, it is important to take these into consideration when choosing the intervention level⁵. The protective actions as set out in the *Preparedness and Response for a Nuclear or Radiological Emergency* and the *Arrangements for Preparedness for a Nuclear or Radiological Emergency* are summarised in the paragraphs below.

Isolation and prevention of inadvertent ingestion

3.6 In most radiological emergencies involving uncontrolled dangerous sources, individuals can be protected from the radiological hazards by isolating the source and preventing inadvertent ingestion. They can avoid significant exposure due to contact and shine by moving away from a dangerous source, and workers can greatly reduce their dose by the use of remote handling tools. In addition, keeping hands and possibly contaminated objects out of the mouth can prevent inadvertent and possibly fatal ingestion.

⁴ Dose is a general term denoting the quantity of radiation or energy absorbed in a specific mass.

⁵ One of the important concepts in emergency preparedness and response is intervention level, which basically are doses due to radiation at which countermeasures (such as evacuation, sheltering and control of food) should be taken to mitigate the potential adverse impact to public health and safety.

Sheltering

3.7 Sheltering is relatively easy to implement, but it may not be possible to extend it for long periods of time. Sheltering will provide some protection against exposure via all the major exposure pathways during the early phase of a nuclear or radiological emergency and whenever conditions make evacuation dangerous. People should stay in buildings to reduce exposure to airborne contamination and surface deposits, close doors and windows, and turn off ventilation systems to reduce inhalation of radioactive material from outside air. The generic intervention level for sheltering is 10 mSv⁶ of avertable dose⁷ in a period of no more than two days.

Evacuation

3.8 Timely evacuation can prevent exposures via all possible exposure pathways and remove individuals from the proximity of the emergency. The generic intervention value of temporary evacuation is 50 mSv of avertable dose in a period of no more than one week.

Respiratory protection and protective clothing

3.9 The respiratory protection equipment typically used by firemen provides good protection against the inhalation hazard for most emergencies involving an airborne release of radioactive material. Meanwhile, skin contamination is not a major threat, provided that simple steps are taken to protect the skin and prevent inadvertent ingestion. Generally, skin contamination can be avoided by standard protective clothing.

⁶ Millisievert (mSv) means one thousandth of a Sievert (Sv), a unit of measuring radiation.

⁷ Intervention levels in emergency exposure situations are expressed in terms of avertable dose, i.e. a protective action is required if the dose that can be averted is greater than the corresponding dose for the intervention level.

Decontamination of individuals

3.10 People can be contaminated by airborne radioactive releases and by handling radioactive material. Simply changing clothing, showering or washing exposed skin can reduce dangerous levels of contamination and prevent the spread of contamination at significant levels.

Prophylaxis with stable iodine

3.11 Stable iodine prophylaxis involves taking potassium iodide orally, thereby preventing deterministic effects in the thyroid gland and reasonably reducing the risk of stochastic effects from the inhalation of radioiodine within or near the facility. Stable iodine prophylaxis must be administered before or soon after the intake of radioiodine⁸ so as to achieve maximum effectiveness. The generic intervention level for prophylactic use of iodine is 100 mGy⁹.

Temporary relocation

3.12 People can be removed for an extended but limited period of time (such as several months) to avoid doses from radioactive material deposited on the ground and from local food or water. The generic intervention level for initiating and terminating temporary relocation are 30 mSv in a month and 10 mSv in a month respectively.

Permanent resettlement

3.13 If the dose exceeds 10 mSv per month within a year or two, permanent resettlement with no expectation of return to homes should be considered. Permanent resettlement should also be considered if the lifetime dose is projected to exceed 1 Sv.

⁸ Radioiodine is a colourless liquid containing a radioactive form of iodine.

⁹ Milligray (mGy) is the unit of absorbed radiation dose of ionizing radiation.

Protection of food and water supplies and restriction of significantly contaminated food and water supplies

3.14 Following a major release of radioactive material from a facility, the primary sources of exposures may be the ingestion of contaminated food or water. Possible protective actions include:

- (a) instructing the public not to consume milk from animals that may graze on possibly contaminated ground;
- (b) protecting the important sources of food and water from contamination (e.g. to disconnect rainwater collection pipes); and
- (c) promptly conducting monitoring and implementing the appropriate restrictions on food and drinking water from rainwater within the area where food or water may be contaminated to levels warranting restrictions.

The generic action levels depend upon the type of foodstuff and the type of radioactive contaminants.

Protection of international trade and commercial interests

3.15 Nuclear and radiological emergencies that have occurred in the past have had major adverse economic consequences. This was in part because steps were not taken immediately to reassure people, including national and international customers. For protecting international trade after a nuclear or radiological emergency, there should be provisions for taking measures immediately to ensure that all goods in trade meet international standards.

Medical management

3.16 Nuclear and radiological emergencies warrant taking immediate action to treat and identify those who should receive long-term medical follow-up.

Emergency Planning Zone

3.17 For emergency preparedness and response, Emergency Planning Zone ("EPZ") is an important concept which refers to the offsite area around a facility for which planning and preparation are made in advance to ensure that necessary and effective protection actions can be taken to protect the public, property or the environment in the case of an accident. There are three EPZs established under the IAEA Safety Standards:

Precautionary Action Zone

3.18 Precautionary Action Zone (with a radius of three to five km) is the area around a facility where urgent protective actions have been pre-planned and will be implemented immediately upon declaration of a general emergency. Protective actions such as substantial sheltering, evacuation and distribution of stable iodine prophylaxis should be recommended immediately when severe conditions are detected in the facility without waiting for monitoring.

Urgent Protective Action Planning Zone

3.19 Urgent Protective Action Planning Zone (with a radius of five to 30 km) is the area around a facility where preparations are made to promptly implement urgent protective actions based on environmental monitoring. Plans and capabilities should be developed to implement sheltering or evacuation and distribute stable iodine prophylaxis.

Longer Term Protective Action Planning Zone

3.20 Longer Term Protective Action Planning Zone (with a radius of 50 to 100 km) is the area furthest from a facility where more time will be available to take effective actions. Protective actions such as relocation and food restrictions will be based on environmental monitoring and food sampling.

4. Latest development on International Atomic Energy Agency's Safety Standards

4.1 IAEA published the General Safety Guides document, *Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency* in March 2011 and the General Safety Requirements Part 3 document, *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards Interim Edition* in November 2011. These two publications indicate that the system of generic intervention levels and the generic action levels that have been described in previous safety standards were replaced by the generic criteria.

4.2 The table below summarizes the generic criteria for protective actions and other response actions in emergency exposure situations to reduce the risk of stochastic effects.

Table – Generic criteria for protective actions and other response actions

Generic criteria		Examples of protective actions and other response actions
Urgent protective actions and other response actions to be taken if projected dose that exceeds the following generic criteria		
Equivalent dose in thyroid	50 mSv in the first seven days	Iodine thyroid blocking
Effective dose	100 mSv in the first seven days	Sheltering; evacuation; decontamination; restriction of consumption of food, milk and water; contamination control; and public reassurance
Equivalent dose for fetus	100 mSv in the first seven days	
Protective actions and other response actions to be taken early in the response if projected dose that exceeds the following generic criteria		
Effective dose	100 mSv per annum	Temporary relocation; decontamination; replacement of food, milk and water; and public reassurance
Equivalent dose for fetus	100 mSv for the full period of in utero development	

Table – Generic criteria for protective actions and other response actions (cont'd)

Generic criteria		Examples of protective actions and other response actions
Dose that has been received and that exceeds the following generic criteria should take longer term medical actions to detect and to effectively treat radiation induced health effects		
Effective dose	100 mSv in a month	Screening based on equivalent doses to specific radiosensitive organs as a basis for medical follow-up and counseling
Equivalent dose for fetus	100 mSv for the full period of in utero development	Counseling to allow informed decisions to be made in individual circumstances

5. Action Plan of the International Atomic Energy Agency on nuclear safety endorsed in September 2011 after the Fukushima nuclear accident

5.1 During 20-24 June 2011, IAEA held its Ministerial Conference on Nuclear Safety to identify lessons learned from the nuclear accident happened at the Fukushima Daiichi Nuclear Power Station. The Conference adopted a Ministerial Declaration calling for strengthening nuclear safety, emergency preparedness and radiation protection of people and environment worldwide. The Declaration has formed the basis of the IAEA Action Plan on Nuclear Safety, which was approved by the IAEA Board of Governors and endorsed in the General Conference held in September 2011. Subsequently, a Nuclear Safety Action Team has been set up by IAEA to oversee prompt implementation of the Action Plan and ensure proper coordination among all stakeholders.

5.2 IAEA's Action Plan on Nuclear Safety sets out 12 main actions requiring the Member States to:

- (a) promptly undertake assessment of the safety vulnerabilities of nuclear power plants in the light of lessons learned from the accident, embark on the review of the design of nuclear power plants against site specific extreme natural hazards and implement the necessary corrective actions in a timely manner;
- (b) strengthen existing IAEA peer reviews by incorporating lessons learned and by ensuring that these reviews appropriately address regulatory effectiveness, operational safety, design safety, and emergency preparedness and response;
- (c) work with the IAEA Secretariat and relevant international organizations to review and strengthen the emergency preparedness and response framework;
- (d) conduct a prompt national review and thereafter regular reviews of their regulatory bodies, including an assessment of their effective independence, adequacy of human and financial resources and the need for appropriate technical and scientific support, to fulfil their responsibilities;
- (e) ensure improvement of management systems, safety culture, human resources management, and scientific and technical capacity in operating organizations with respect to nuclear safety;
- (f) utilize as broadly and effectively as possible the IAEA Safety Standards in an open, timely and transparent manner. Meanwhile, the Commission of Safety Standards¹⁰ and the IAEA Secretariat will review and strengthen the Safety Standards and improve their implementation;

¹⁰ The Commission of Safety Standards is a standing body established within IAEA consisting of senior government officials of IAEA's Member States who hold national responsibilities for establishing standards and other regulatory documents relevant to nuclear, radiation, transport and waste safety.

-
- (g) explore mechanisms to enhance the effective implementation of the international legal framework governing the nuclear safety;
 - (h) create an appropriate nuclear infrastructure based on the IAEA Safety Standards and other relevant guidance with the assistance of the IAEA Secretariat;
 - (i) strengthen, develop, maintain and implement their capacity building programmes including education, training and exercises at the national, regional and international levels in order to ensure sufficient and competent human resources necessary to assume their responsibility for safe, responsible and sustainable use of nuclear technologies;
 - (j) co-operate with the IAEA Secretariat and other relevant stakeholders to facilitate the use of available information, expertise and techniques for monitoring, decontaminating and remediating both on and off nuclear sites;
 - (k) strengthen the emergency notification system and the information dissemination arrangements so as to enhance the transparency and effectiveness of communication; and
 - (l) effectively utilize the research and development conducted by the IAEA Secretariat and relevant stakeholders on nuclear safety, technology and engineering.

Research Division
28 November 2011
Updated on 5 December 2011
Tel: 3919 3634

Fact sheets are compiled for Members and Committees of the Legislative Council. They are not legal or other professional advice and shall not be relied on as such. Fact sheets are subject to copyright owned by the Legislative Council Commission (the Commission). The Commission permits accurate reproduction of fact sheets for non-commercial use in a manner not adversely affecting the Legislative Council, provided that acknowledgement is made stating the Research Division of the Legislative Council Secretariat as the source and one copy of the reproduction is sent to the Legislative Council Library.

References

1. International Atomic Energy Agency. (1996) *Nuclear and radiation safety: Guidance for emergency response*. IAEA Bulletin, 1/1996. Available from: <http://www.iaea.org/Publications/Magazines/Bulletin/Bull381/38102682327.pdf> [Accessed November 2011].
2. International Atomic Energy Agency. (2002) *IAEA Safety Standards Series: Preparedness and Response for a Nuclear or Radiological Emergency. Safety Requirements (No. GS-R-2)*. Available from: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1133_scr.pdf [Accessed November 2011].
3. International Atomic Energy Agency. (2006) *IAEA Safety Standards: Fundamental Safety Principles (No. SF-1)*. Available from: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1273_web.pdf [Accessed November 2011].
4. International Atomic Energy Agency. (2007) *IAEA Safety Standards: Arrangements for Preparedness for a Nuclear or Radiological Emergency. Safety Guide (No. GS-G-2.1)*. Available from: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1265_web.pdf [Accessed November 2011].
5. International Atomic Energy Agency. (2011a) *About the IAEA: The "Atoms for Peace" Agency*. Available from: <http://www.iaea.org/About/about-iaea.html> [Accessed November 2011].
6. International Atomic Energy Agency. (2011b) Annex 2: Chairpersons' Summaries. In: *Report of the IAEA Ministerial Conference on Nuclear Safety 20-24 June 2011*. Available from: http://www.iaea.org/About/Policy/GC/GC55/GC55InfDocuments/English/gc55inf-10_en.pdf [Accessed November 2011].
7. International Atomic Energy Agency. (2011c) *Draft IAEA Action Plan on Nuclear Safety*. Available from: <http://www.iaea.org/About/Policy/GC/GC55/Documents/gc55-14.pdf> [Accessed November 2011].

-
8. International Atomic Energy Agency. (2011d) *IAEA General Conference Focuses on Nuclear Safety*. Available from: <http://www.iaea.org/newscenter/news/2011/gc55opens.html> [Accessed November 2011].
 9. International Atomic Energy Agency. (2011e) *IAEA Safety Standards: Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency. General Safety Guide (No. GSG-2)*. Available from: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1467_web.pdf [Accessed November 2011].
 10. International Atomic Energy Agency. (2011f) *IAEA Safety Standards: Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards. Interim Edition. General Safety Requirements Part 3 (No. GSR Part 3 (Interim))*. Available from: http://www-pub.iaea.org/MTCD/publications/PDF/p1531interim_web.pdf [Accessed November 2011].
 11. International Atomic Energy Agency. (2011g) *Information Circular: Declaration by the IAEA Ministerial Conference on Nuclear Safety in Vienna on 20 June 2011*. Available from: <http://www.iaea.org/Publications/Documents/Infcircs/2011/infcirc821.pdf> [Accessed November 2011].
 12. International Atomic Energy Agency. (2011h) Introduction. In: *Report of the IAEA Ministerial Conference on Nuclear Safety 20-24 June 2011*. Available from: http://www.iaea.org/About/Policy/GC/GC55/GC55InfDocuments/English/gc55inf-10_en.pdf [Accessed November 2011].
 13. International Atomic Energy Agency. (2011i) *Nusafe tutorial. Safety objectives*. Available from: <http://www.iaea.org/ns/nusafe/tutorial/safobj/nsobj.htm> [Accessed November 2011].
 14. International Atomic Energy Agency. (2011j) *Speech by IAEA Director General: Statement to Fifty-Fifth Regular Session of IAEA General Conference 2011*. Available from: <http://www.iaea.org/newscenter/statements/2011/amsp2011n021.html> [Accessed November 2011].
-