

# Safety Principles Underlying the NUSS Documents

---

by D.G. Hurst

In the preparation of the Safety Codes and Guides of the IAEA's Nuclear Safety Standards\* (NUSS) programme, information is sought from Member States and forms the basis of drafts initially prepared by experts. These drafts are subsequently reviewed and amended by technical review committees and the NUSS programme's Senior Advisory Group (SAG), taking into account comments from Member States on the drafts. As a result, safety principles in use by many national authorities have been incorporated in the documents. Now that all five codes and several guides have been published and many other guides are well advanced, it is appropriate to prepare a compilation of the most important safety principles underlying the documents. The distinction between the most important principles and the many secondary principles occurring in the guides is not sharply defined and the choice for the following list is admittedly somewhat arbitrary. The list has not been endorsed by SAG as regards either content or wording but it has benefitted from comments made by members of SAG and the IAEA Secretariat.

- (1) The nuclear power plant shall be sited, designed, constructed and operated in such a way that:
  - (a) The radiological exposure of all persons is in accord with national requirements and is as low as is reasonably achievable, and
  - (b) The radiological risk to all persons from accidents is acceptably low in accord with national requirements.
- (2) Preventing the escape of fission products to the environment is of prime importance to safety. Escape is normally prevented by a sequence of barriers some of which perform other functions. Duality of purpose of barriers must not be allowed to jeopardize safety.
- (3) The design of structures, systems and components shall be such as to prevent, or mitigate the consequences of, credible events or combinations of events which could, directly or indirectly, render ineffective any of the barriers.
- (4) The assessment of site characteristics, particularly as regards potential natural phenomena (earthquakes, floods, hurricanes etc.) and potential man-induced external events (aircraft crashes, explosions, etc.), should result in the establishment of parameters characterizing the most severe external phenomena and events required to be considered in

---

Dr Hurst is Chairman of the NUSS programme's Scientific Advisory Group and a former president of the Atomic Energy Control Board, Ottawa

\* Safety is defined in the NUSS programme as "protection of all persons from undue radiological hazard".

the design. If practical values of the parameters cannot be chosen the site should be rejected.

(5) Special attention shall be given in the design to ensuring reliable shutdown of the reactor, cooling of the core, and removal of residual heat, as required for the preservation of the barriers following any credible event or credible combination of internal or external events.

(6) The site characteristics must be such as to provide reliable long-term heat removal capability, i.e. there must be a reliable ultimate heat sink.

(7) A legally constituted entity, a Regulatory Body, should be established with power to authorize and control the installation and operation of nuclear power plants in the interest of safety (Such a body may have additional functions but NUSS is concerned only with safety)

(8) The Regulatory Body should have the statutory authority needed to enable it to perform its functions and should not be responsible for the promotion or production of nuclear power. It should be independent from other organizations, especially those concerned with the promotion and production of nuclear power, to the degree necessary to permit it to perform its function without interference.

(9) Before authorizing construction of a nuclear power plant, the Regulatory Body shall satisfy itself by appropriate reviews and assessments that the safety aspects of siting, design and construction are satisfactory.

(10) Before authorizing the operation of a nuclear power plant, the Regulatory Body shall satisfy itself by appropriate reviews and assessment that the siting, design, and construction together with proposed operating procedures, operational limits and conditions and the emergency plan provide adequate safety

(11) The Regulatory Body shall maintain surveillance of the operation of all nuclear power plants under its jurisdiction, permitting continued operation only if it considers operation to be safe.

(12) A clearly delineated Operating Organization shall have overall responsibility for the safe operation of each nuclear power plant

(13) Operational limits and conditions shall form an important part of the basis on which the Operating Organization is authorized to operate the plant These shall cover, among other matters,

- (a) constraints on process variables and on other important parameters,
- (b) safety systems settings,
- (c) requirements for maintenance, testing and inspection of the plant to ensure that structures, systems and components function as assumed in the design.

(14) An emergency plan shall be prepared and shall provide for co-ordination of the appropriate organizations and for implementation of measures required in the event of an accident leading to, or likely to lead to, dispersal of a significant amount of radioactive material beyond the site boundary.

(15) All reasonable precautions shall be taken in order to prevent persons from carrying out unauthorized actions intended to, or likely to jeopardize safety.

(16) A quality assurance programme shall be established and implemented

(17) The quality assurance programme shall apply to activities that affect quality such as designing, purchasing, fabricating, manufacturing, handling, shipping, storing, cleansing, erecting, installing, testing, commissioning, operating, examining, inspecting, maintaining, repairing, refuelling, modifying and decommissioning.

(18) At the design stage, special attention shall be paid to measures which would facilitate maintenance, decontamination of equipment, and decommissioning of the plant

(19) Decommissioning shall be conducted in accordance with a planned programme for ensuring safety.