An Overview of the Nuclear Safety Standards (NUSS) Programme

Introduction

The demand for energy is continually growing, both in the developed and the developing countries. Traditional sources of energy such as oil and gas will probably be exhausted within a few decades, and present world-wide energy demands are already overstraining available capacity. Of the new sources, nuclear energy, with its proven technology, is the most significant single reliable source for closing the energy gap that is likely, according to the experts, to be upon us by the turn of the century.

During the past 25 years, 21 countries have constructed nuclear power plants. More than 200 power reactors are now in operation, a further 150 are planned, and, in the longer term, nuclear energy is expected to play an increasingly important role in the development of energy programmes throughout the world. In all these programmes, nuclear safety will be a topic of prime importance.

The safety of nuclear power plants in any country rests on many requirements. One is an adequate supply of trained personnel for design, construction and operation of these plants and to staff a regulatory body. They should be able to conduct a careful and detailed safety evaluation of a nuclear power plant project from its inception and at all stages throughout its life. An appropriate quality assurance programme including control and inspection is also necessary. If these conditions are met, it is possible for the authorities of the country to assure themselves that nuclear power plants can be built and operated safely. Formalized safety criteria in the form of codes, guides, etc. can be of considerable assistance in ensuring that the basic requirements are understood and met. It must be emphasized, however, that safety criteria cannot be treated in isolation, and can only be used effectively by qualified personnel. Similarly, it is essential that regulatory and project personnel of a country proposing to build a nuclear power plant obtain in-depth knowledge of the characteristics of the type of plant it plans to build and operate and of the available body of pertinent information related to safety and regulatory activities, particularly in the country of origin of the plant.

During the initial period in the development of nuclear power the Agency was not in a position to prepare safety criteria except in a few fields. Hence, a case-by-case approach to matters of nuclear power plant safety was often adopted by the Agency, an approach more time-consuming and less consistent in its results than if such criteria were available. It is clear that such a case-by-case treatment of safety is not adequate in the context of rapidly expanding world-wide use of nuclear power and the associated international trade. As in several other fields, it is desirable to collate and prepare safety codes and guides that

can be used by regulatory bodies, utilities, designers and constructors, especially in view of the number of countries embarking for the first time on nuclear power programmes and in the process of setting up their own regulatory procedures.

Organization and Objectives

In September 1974, a Senior Advisory Group (SAG) was set up to implement the programme. This Group was entrusted with the task of supervising, reviewing and advising on the project at all stages and approving draft documents for onward transmittal to the Director General. The SAG selected topics to be covered by Codes of Practice and drew up a provisional list of subjects for Safety Guides. One Technical Review Committee, composed of experts from Member States, was created for each of the topics covered by the Codes of Practice. The five Codes of Practice deal with the topics:

- governmental organization for the regulation of nuclear power plants;
- safety in nuclear power plant siting;
- design for safety of nuclear power plants;
- safety in nuclear power plant operation;
- quality assurance for safety in nuclear power plants.

In order to reflect the different approaches which are possible, the programme for this work had to take into account national standards, guides, practices, the contributions which could be made by Member States having experience in nuclear power plant safety, and the activities of other organizations. The immediate objective of the programme is to collate and develop recommendations, as far as possible and necessary, for the safety of thermal neutron power plants.

In evaluating what was possible account had to be taken of (i) the amount of relevant knowledge and experience accessible as a basis for useful recommendations, and (ii) the expert manpower and other means available for implementation of the procedures of this programme.

In determining what was necessary, three areas had to be considered: (i) the types of recommendations most important for the safety of nuclear power plants, (ii) the types of recommendations which are requested by Member States soliciting advice or assistance from the Agency, and (iii) the types of recommendations that the Agency needs for Agency projects.

Two classes of documents are being produced by the programme to fulfil different needs.

Codes of Practice for thermal neutron nuclear power plants set out the objectives and minimum requirements which must be fulfilled to provide adequate safety for these plants, their systems and components.

Safety Guides recommend a procedure or procedures that might be followed to implement the Codes of Practice. In order to provide for Agency safety guides, the various existing national guides, standards and practices had to be collated. This collation is made to ensure that Agency guides are fully representative of relevant national practices. Such a fully representative picture is a prerequisite to the drafting of an Agency safety guide.

Although the immediate objective of the programme is to prepare an internationally agreed set of recommendations on the safety of thermal neutron nuclear power plants, other

objectives have also been set out. These are to review the resulting codes and guides to take into account advances in technology and the experience gained in using them, and to promote the use in national regulations and international standards of the Agency's safety codes and guides.

In addition, it is intended to extend the safety standards programme to the preparation of codes and guides for nuclear fuel cycle facilities. As the various national safety standards for advanced nuclear power plants will likely have been issued by 1980, work could start then on Agency standards for such plants in the ensuing years.

Progress to Date and Plans

In the five major topic areas (governmental organization, siting, design, operation and quality assurance), the Codes of Practice and a number of the Guides have now been completed, and work is in progress on the remaining safety guides. By subject area, these safety guides are listed below along with their identifying numbers.

Governmental Organization

50-C-G Code of Practice on Governmental Organization for the Regulation of Nuclear Power Plants.
50-SG-G1 Qualifications and Training of Staff of the Regulatory Body for Nuclear Power Plants.
50-SG-G2 Information to be Submitted in Support of Licensing Applications for Nuclear Power Plants.
50-SG-G3 The Conduct of Regulatory Review and Assessment during the Licensing Process for Nuclear Power Plants.
50-SG-G4 Inspection and Enforcement by the Regulatory Body for Nuclear Power Plants.
50-SG-G6 Preparedness of Public Authorities for Emergencies at Nuclear Power Plants.
50-SG-G8 Licences for Nuclear Power Plants: Content, Format and Legal Considerations.

Siting

50-C-S Code of Practice on Safety in Nuclear Power Plant Siting (NPPS).
50-SG-S1 Earthquakes and Associated Topics in relation to Nuclear Power Plant Siting.
50-SG-S2 Seismic Analysis and Testing of Nuclear Power Plants.
50-SG-S3 Atmospheric Dispersion in relation to Nuclear Power Plant Siting.
50-SG-S4 Site Selection and Evaluation for Nuclear Power Plants with respect to Population Distribution.
50-SG-S5 Extreme Man-Induced Events in relation to Nuclear Power Plant Siting.
50-SG-S6 Hydrological Dispersion of Radioactive Material in relation to Nuclear Power Plant Siting.
50-SG-S7 Nuclear Power Plant Siting – Hydrological Aspects.
50-SG-S9 Site Survey for Nuclear Power Plants.
50-SG-S10A Determination of Design Basis Floods for Nuclear Power Plants on River Sites.
50-SG-S10B Determination of Design Basis Floods for Nuclear Power Plants on Coastal Sites.
50-SG-S11 Evaluation of Extreme Meteorological Events for Nuclear Power Plant Siting.

Design

50-C-D	Code of Practice on Design for Safety of Nuclear Power Plants.
50-SG-D1	Safety Functions and Component Classification for Boiling Water Reactors (BWR), Pressurized Water Reactors (PWR) and Pressure Tube Reactors (PTR).
50-SG-D2	Fire Protection in Nuclear Power Plants.
50-SG-D3	Protection Systems and Related Features in Nuclear Power Plants.
50-SG-D4	Protection Against Internally-Generated Missiles and their Secondary Effects in Nuclear Power Plants.
50-SG-D5	Man-Induced Events in relation to Nuclear Power Plant Design.
50-SG-D6	Ultimate Heat Sink and Directly Associated Heat Transport Systems for Nuclear Power Plants.
50-SG-D7A	Emergency Electrical Power Systems at Nuclear Power Plants.
50-SG-D8	Instrumentation and Control of Nuclear Power Plants.
50-SG-D9	Design Aspects of Radiological Protection for Operational States of Nuclear Power Plants.
50-SG-D10	Fuel Handling and Storage Systems in Nuclear Power Plants.

Operation

50-C-O	Safety in Nuclear Power Plant Operation Including Commissioning and Decommissioning.
50-SG-01	Staffing of Nuclear Power Plants and Recruitment, Training and Authorization of Operating Personnel.
50-SG-02	In-Service Inspection for Nuclear Power Plants.
50-SG-03	Operational Limits and Conditions for Nuclear Power Plants.
50-SG-04	Commissioning Procedures for Nuclear Power Plants.
50-SG-05	Radiological Protection during Operation of Nuclear Power Plants.
50-SG-06	Preparedness of the Operating Organization for Emergencies at Nuclear Power Plants.
50-SG-07	Maintenance of Nuclear Power Plants.
50-SG-08	Standard Tests of Important Systems and Components in Nuclear Power Plants.

Quality Assurance

50-C-QA	Quality Assurance for Safety in Nuclear Power Plants
50-SG-QA1	Preparation of the Quality Assurance Programme for Nuclear Power Plants.
50-SG-QA2	Quality Assurance Records System for Nuclear Power Plants.
50-SG-QA3	Quality Assurance in the Procurement of Items and Services for Nuclear Power Plants.
50-SG-QA4	Quality Assurance during Site Construction of Nuclear Power Plants.
50-SG-QA5	Quality Assurance during Operation of Nuclear Power Plants.
50-SG-QA6	Quality Assurance in the Design of Nuclear Power Plants.
60-SG-QA7	Quality Assurance Organization for Nuclear Power Plants.
50-SG-QA8	Quality Assurance in the Manufacture of Items for Nuclear Power Plants.
50-SG-QA10	Quality Assurance Auditing for Nuclear Power Plants.
50-SG-QA11	Quality Assurance in the Design and Manufacture of Fuel and Fuel Cladding for Nuclear Power Plants.

About 10 of these safety guides are expected to be published each year through to 1982, by which time the originally envisaged set of codes and guides will be complete. The codes and guides already issued will be revised or supplemented in the light of experience gained with them in practice and of further experience in operating the present generation of nuclear power plants. The use of the codes and guides in establishing national regulations and international standards will be promoted through the preparation of manuals for their application and through Agency participation in national and international meetings.