NUCLEAR POWER STATION SAFETY AND PERFORMANCE MANAGEMENT

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My task here today is twofold. Firstly, I want to tell you something of the role which we at the Atomic Energy Control Board believe quality assurance must play in the context of nuclear power stations. Secondly, as a member of the Canadian Nuclear Association CNA N286 Sub-committee on "Nuclear Power Station QA", I would like to describe to you some of the philosophy behind the system of QA standards being developed by that group. These are standards which those of you participating in the Canadian nuclear power program will be bound to meet.

To begin with, I should outline the general responsibilities of the Atomic Energy Control Board (AECB) and explain how these lead to the licensing of nuclear power stations in Canada.

The Atomic Energy Control Act, which came into force in 1946, constituted the Atomic Energy Control Board and authorized it to control atomic energy materials and equipment in the national interest and to participate in measures for international control of atomic energy as might thereafter be agreed. More specifically, the Act authorized the Board to make regulations to control atomic energy materials and equipment and to award grants in support of atomic energy research.

Originally, the Board was responsible for controlling the entire Canadian atomic energy program, including the original Chalk River Project. However, the research, development and promotional aspects of the Canadian program became the
responsibility of Atomic Energy of Canada Limited when that crown corporation was established under the Act in 1952. Since a 1954 amendment to the Act, the Board's role has involved only the regulatory and granting aspects of the Canadian atomic energy program.

The basic role of the Board is to control atomic energy materials and equipment in the interests of health, safety and physical security; to control atomic energy materials, equipment and information in the interests of national and international security; to award grants in aid of atomic energy research; and finally, to administer certain aspects of the Nuclear Liability Act once it is proclaimed.

The Board exercises control through the Atomic Energy Control Regulations and through a comprehensive licensing system. Included in this system is, of course, the licensing of individual nuclear power stations following detailed assessment and consideration of their safety.

The reactor safety assessment process is punctuated by three major licensing actions: site evaluation and approval, issuance of a construction permit, and issuance of an operating license. So far this process has been paced to the evolving design for each reactor plant so that its overall duration has been typically about five years. Assessment of safety begins at the site evaluation phase with a general appraisal of the type of reactor, its power rating, and containment system, in the context of the proposed site and proximity to population centres. When application for a construction permit is made, a preliminary safety report is submitted to the AECB and this
contains more detailed information on the station's nuclear steam supply and other systems together with analysis of postulated accidental events and their consequences. The nature and predicted effectiveness of the main nuclear process systems (e.g. reactor fuel, coolant system, moderator system regulating system) and important conventional process systems (e.g. steam and feedwater systems, process water system, electrical power system) are examined and evaluated by AECB staff in consultation with a Reactor Safety Advisory Committee (RSAC). Also examined in detail are the nuclear safety systems (e.g. reactor trip system, emergency core cooling system, containment system), their nature and predicted effectiveness. The activities of evaluation and compliance checking of design, construction, installation, and testing of the station continue through to re-examination of a final version of the safety report and, on the recommendation of the RSAC and the AECB staff, ultimate granting of an operating license. After the issuance of an operating license the performance of each station continues to come under frequent and regular review by visiting, or on-site AECB inspection officers to ensure the terms of the license and the various licensing documents are being complied with.

After that brief outline of AECB practice, I would like to return to the title of my talk and to explain why it includes the words "safety and performance management" and not "quality assurance" which, after all, is the topic of our meeting.

In a very real way the term "quality assurance" is synonymous with "good management" so that successful safety and performance management of a nuclear power station can be achieved by means of a properly planned and implemented
quality assurance program. As I have noted, the AECB's concern is with station safety. However, there is a heavy overlap between station safety and station performance and to a large extent the mandatory overall QA program required by the AECB of a station owner will provide confidence that the station will not only operate safely, but will also perform reliably as an electricity producer. By extending the QA program, however, to include non-safety, performance-related structures systems and components the station owner can likely improve even more his management and control of overall station performance with obvious benefits.

There can be no doubt that the highly complex collection of structures, system and components which constitutes a nuclear power station, must be subject to a systematized management process through all phases of the project if the station is to perform safely and successfully.

The task of making sure a nuclear power station and its many structures, systems and components are designed, manufactured, constructed, tested and then operated safely is a substantial one. While it has not been identified as a quality assurance problem, this task has, of course, been addressed in the past by the AECB and also by the station owner. Indeed, as the regulatory body engaged in the safety assessment, licensing and compliance checking of nuclear power stations one might say that a major part of the AECB's work is quality assurance in nature.

Since the AECB and the nuclear industry are apparently experienced practitioners of what has become known as quality assurance, one might reasonably wonder why changes to our
respective practices should be considered. After all, a high degree of safety and successful electricity production have been realized so far with CANDU reactor power plants. In the AECB's view, there are very good reasons for making changes.

The nuclear power program in Canada has already entered a period of expansion. This expansion carries with it an increased challenge for all of us to continue to do our jobs in an orderly and consistent fashion. We cannot hope to meet this challenge properly without rationalizing our approach to quality and quality assurance. Quality assurance must become more visible, more identifiable; it must become better organized and better co-ordinated. Quality assurance in individual areas of activity must be conducted according to discrete programs which should then be integrated into a single overall quality assurance program so that a complete and coherent quality picture of each new station emerges.

In order to do this, all existing quality assurance practices must be identified as such and come under general review. Once agreement on their adequacy is achieved the required practices must be recorded in reference standards. The Canadian Standards Association preliminary standards series CSA Z299 on quality assurance for procurement and manufacture of individual components is an excellent example of what can be achieved by this approach.

Thus, the AECB is convinced that nuclear power station quality and the assurance thereof, is vital to the safety of these plants. Anything less than a full and complete commitment by designers, manufacturers, constructors and operators to the quality and assurance of quality of the structures,
systems, components, and administrative activities on which the nuclear safety of these plants depend is clearly unacceptable. We believe that industry and the station owners cannot afford a half-hearted or divided approach to quality and neither can the public whose health and safety interests the AECB represents.

So much for the general, regulatory argument for the need for demonstrable nuclear station QA, or safety management. But how should this requirement be met? What are the more detailed, working requirements?

These are questions which the Canadian Nuclear Association's N286 Sub-committee on "Nuclear Power Station Quality Assurance" is endeavouring to answer. This Sub-committee of the main CNA "Codes, Standards and Practices Committee" is composed of members representing nuclear system designers, consulting engineers, constructors, commissioning engineers, equipment designers and manufacturers, electric power utilities and jurisdictions from the three provinces with nuclear power station commitments. To deal with the problem of nuclear power station QA the Sub-committee has initiated a QA standards-writing program which is in two parts. These parts are being pursued in parallel, with one slightly ahead of the other.

The first part involves the preparation by the Sub-committee of an "umbrella" standard containing overall nuclear power station QA requirements. This document when completed should indicate to a station owner the main requirements that must be met when establishing and implementing an overall QA program to manage station safety. In addition, the standard
will cross-reference a series of supporting second-tier standards which will contain more detailed requirements for the various constituent areas of activity associated with a nuclear power station. Areas such as design, procurement and manufacturing, construction, commissioning, and operation.

It is the drafting of these second-tier standards which forms the second part of the QA standards-writing program. Preparation of the umbrella document by the Sub-committee is the lead activity with preparation of the more detailed standards following. The supporting standards will be tied to the overall standard by more than cross-references. They will in fact reflect in greater detail the QA philosophy embodied in the requirements stated in the overall document. In short, the overall and the second-tier documents will belong together as in a family.

To expedite drafting of the second-tier standards and also bring to bear the necessary specialist expertise, the Sub-committee is forming individual Working Groups to address each topic. The respective chairmen of these Groups will be Sub-committee members. Drafts by the individual Working Groups will be communicated to the Sub-committee for discussion, and approval.

Once the combined work of the Sub-committee and its advisory Working Groups reaches an advanced stage the Sub-committee will assume the identity of a Canadian Standards Association (CSA) Standards Committee. In this way the documents when completed will be published as preliminary CSA standards. One of the second-tier QA standards which will be referred to by the overall N286 standard is, of course, the CSA Z299 series of documents. These already-existing documents will be checked for consistency and then incorporated by reference into the N286 family.
As already mentioned, discussion and review of current Canadian practice is a basic starting point for the drafting of the N286 system of QA standards. Also important is the review and evaluation of selected existing non-Canadian QA standards as valuable information sources.

The ultimate goal with the N286 standards is to provide a means whereby different, but nevertheless satisfactory QA programs, may be prepared by different organizations in a manner appropriate to their own products and way of doing business.

To summarize, quality assurance and all that it entails, has always been an intrinsically important part of the nuclear power station program in Canada. Now, however, the Atomic Energy Control Board is formally requiring that applicants for station licenses establish, define, and implement effective quality assurance programs for each phase of each project. To facilitate compliance with this "cradle to the grave" concept of quality assurance CNA Sub-committee N286 is in the process of developing a system of QA standards. These standards will contain overall and constituent QA program requirements to cover the complete nuclear power station project, and its individual phases respectively.

A final reminder. QA is nothing more than a visible systematized approach to management. It is an essential part of our endeavours to ensure that nuclear power stations, as they increase in number, continue to be safe. However, the QA concept will not work unless each of us, from senior managers to detailed activity performers, understands the goal and follows the spirit and intent, as well as the rules, of QA through to its accomplishment. Lip service alone will not be sufficient.