THE NEW CANADIAN STANDARD IN DECOMMISSIONING – N294-09: DECOMMISSIONING OF FACILITIES CONTAINING NUCLEAR SUBSTANCES

M. Stephens

Chair, CSA Technical Committee on Decommissioning of Nuclear Facilities

ABSTRACT

Canadian Standards Association (CSA) released the first edition of the N294 Standard, *Decommissioning of facilities containing nuclear substances*, in English in 2009 July and in French in 2011 January.

The Standard was developed to provide direction to Canadian groups that are decommissioning facilities and sites that have been used for activities involving nuclear substances. The Standard is intended to be consistent with Canadian and international recommendations. It incorporates current best practices and existing regulatory requirements, and draws on the decommissioning experience of the Canadian nuclear industry.

The Standard was developed by the CSA Technical Committee (TC) on the Decommissioning of Nuclear Facilities, under the jurisdiction of the Nuclear Strategic Steering Committee (NSSC). The TC includes experts from across the nuclear industry, government and regulatory authorities, and other stakeholders.

The paper outlines the rationale behind and content of the N294-09 Standard. The Standard applies to the decommissioning of licensed facilities and other locations where nuclear substances are managed, possessed, or stored. The Standard describes requirements and guidelines for the detailed decommissioning process in terms of four phases: planning, preparation, execution and completion. Annexes provide guidance on practical aspects such as preparing preliminary decommissioning plans, estimating decommissioning costs, conducting surveys, preparing end state reports, and on handling particular situations such as decommissioning mine waste rock and tailings, complex sites, and small facilities.

The Standard is now beginning to be applied through the site licences and associated handbooks issued by the Canadian Nuclear Safety Commission (CNSC). It will continue to be improved as experience accumulates.

1. INTRODUCTION

1.1 Canadian Standards Association and the N-series Standards

Canadian Standards Association (CSA) (www.csa.ca) is a not-for-profit membership-based organization serving business, industry, government and consumers in Canada and around the globe. CSA develops Standards designed to enhance public safety and health, advance the quality of life, and help to preserve the environment, and facilitate trade. CSA Standards are developed through a process accredited by the Standards Council of Canada. Volunteers represent a "balanced matrix" committee, which seeks to balance vested interests and viewpoints among various stakeholders, with no single group dominating. The committee develops the details of the standard by a consensus process, which includes the principles of inclusive participation, and implies substantial agreement among committee members, rather than a simple majority of votes, is necessary. Although CSA administers the process and applies rules to promote fairness in achieving consensus, it does not independently test, evaluate, or verify the content of its Standards.

The CSA Nuclear Strategic Steering Committee (NSSC) oversees the CSA program that manages the extensive "N"-series of CSA nuclear Standards. The standards cover a wide range of activities related to Canadian nuclear reactors and the life cycle of facilities that employ nuclear substances.

1.2 Rationale and history of developing a new CSA standard on decommissioning

In 1992, a CSA Technical Committee (TC) began drafting a Standard for nuclear decommissioning. Although the work of this TC was put on hold indefinitely in 1994 because of resourcing challenges, the final draft produced by the TC formed the starting point for the development of a new "N294" Standard on decommissioning.

In 2005, a NSSC task force (TC1) on Radioactivity Management evaluated a proposal to develop a new Standard or series of Standards on decommissioning. While decommissioning was already being carried out in Canada, insufficient standards and guidance describing the practice were available. The IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (www.iaea.org/Publications/Documents/Conventions/jointconv.html), places obligations on Canada to demonstrate that spent fuel and waste management facilities are designed, operated and decommissioned in a safe manner. The additional CSA Standard(s) on decommissioning would resolve the uncertainties in planning decommissioning and would document acceptable approaches to decommissioning in Canada.

A Task Force on Decommissioning then developed an outline of a potential structure and content of a single Standard on decommissioning, and draft Terms of Reference for a new TC. In June 2007 the NSSC approved the development of the N294 Standard and adoption of a `fast-track` approach to produce it. The TC first met in September 2007. Throughout the development of N294, the TC made regular reports to the NSSC on its progress. The Chair of the TC periodically met with the Chairs of the TCs responsible for the other N-series Standards to discuss common issues in developing Standards (e.g., most effective working methods, coordination of divergent committee member interests, etc). The NSSC was available to assist in resolving these issues, particularly ensuring that the N-series Standards remained internally consistent, that no unnecessary overlaps arose between Standards, and that the Standards meshed

with CNSC requirements and regulations. Development of N294-09 was completed essentially as planned. The English edition was issued in July 2009, and the French edition was issued in January 2011 [1].

1.3 Relationship of CSA N294-09 to the Nuclear Safety & Control Act and CSA N286-05

Civilian nuclear activities in Canada are regulated by the Canadian Nuclear Safety Commission (CNSC) (www.nuclearsafety.gc.ca). The Director General Nuclear Safety (DGNS) (www.nuclearsafety.forces.gc.ca) is accountable for the nuclear safety program for the military activities involving nuclear substances undertaken by the Department of National Defence. The CNSC and DGNS have issued extensive mandatory requirements and regulations covering their respective areas of responsibility. The CNSC is interested in seeing adopted, where possible, the voluntary Standards developed by CSA. The goal is to complement its requirements through the addition of broadly-supported expectations for conducting nuclear activities in the Canadian context.

N294-09 is therefore intended to complement, not replace, CNSC requirements. Thus, like all CSA N-series Standards, N294-09 should not be considered as a replacement for the requirements contained in the *Nuclear Safety and Control Act* (1997) and its Regulations, or in other legislation, standards, or guides.

The CSA N286-05 Standard defines the characteristics of good management systems for nuclear power plants. The organizational principles in N286 are fundamental to fostering nuclear safety, and so they are also applied in developing the management systems for other nuclear facilities (e.g., research reactors, "active" research laboratories, fuel fabrication facilities, isotope production hot cells). In developing N294, the TC was aware that it would necessarily deal with the organizational and administrative aspects of managing decommissioning activities. Care was needed not to duplicate or contradict the requirements of N286-05. The focus of N294 was placed on the organizational aspects that are specific to decommissioning (e.g., planning and collecting information for decommissioning throughout a facility life cycle, the timing and content of successive decommissioning plans, facility surveys, and the requirements and lengthy retention period for records documenting the final state of a decommissioned facility).

N294-09 was developed by consensus (defined by CSA as substantial agreement, which is much more than a simple majority but not necessarily unanimity) of the TC. As with all CSA Standards, it remains the responsibility of the users of the N294-09 Standard to judge its suitability for their particular purpose.

1.4 Relationship of CSA N294-09 to existing Standards and regulatory requirements

When development of N294 began, a variety of Canadian and international standards and guidelines on decommissioning already existed or were under development, including:

- CSA N286.6-98 [2] on decommissioning Quality Assurance (QA) for nuclear power plants, which was in use by CNSC licensees whose licences were based on that generation of QA Standards;
- CSA N286-05 [3] on management systems for the entire life cycle of nuclear power plants, which was entering use through new licences being issued by the CNSC;

- CNSC Regulatory Guide G-219 [4], which governed decommissioning planning for activities licensed by the CNSC;
- CNSC Regulatory Guide G-206 [5], which set the requirements for ensuring that CNSC licensees would have sufficient funds to decommission their facilities when required;
- Numerous technical documents and reports had been issued by the International Atomic Energy Agency (IAEA) (www.iaea.org) and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD-NEA) (www.oecd-nea.org) on generic principles, organization and practical aspects of decommissioning;
- Numerous documents issued in the United States by the Department of Energy, the Environmental Protection Agency, the Nuclear Regulatory Commission, and the American Society of Mechanical Engineers (ASME) [6], which together provided extensive regulatory and practical guidance on the practices used in the large decommissioning programs under way in the US.

Technical Committee #85 (Nuclear Energy) of the International Organization for Standardization (ISO) was also considering developing an international standard on decontamination and decommissioning of nuclear fuel cycle facilities.

To support the work of the TC, the CNSC funded the collection and evaluation of these existing documents [7]. They are identified in the list of references in the main text of the N294-09 Standard [1], or in the bibliography in its Annex J.

1.5 Obtaining copies of CSA N294-09

Copies of CSA N294-09 may be purchased through the CSA Online Store at www.ShopCSA.ca.

2. DEVELOPMENT OF CSA N294-09

2.1 Roles

2.1.1 Technical Committee

The TC is comprised of members representing many points of view relating to decommissioning. The TC developed, reviewed, controlled the technical content, and had final approval of the Standard. At least two, and no more than four voting (V) members must come from each of five groups: 1) Owner/ Operator/ Producer; 2) Government and/or Regulatory Authority; 3) Supplier/ Fabricator/ Contractor; 4) Service Industry; 5) General Interest. An organization may have no more than one vote on the TC. Additional members are non-voting Associate (A) members. Table 1 shows the membership of the TC as of April, 2011.

2.1.2 Executive Committee

The Executive Committee of the TC consists of the Chair, the two Vice-chairs and the CSA Project Manager. The Executive Committee provides direction to the TC, and organizes and manages the practical details of its activities.

2.1.3 Core Working Group

The TC was too large to be able to develop draft text for the Standard in an efficient manner. A group of about six TC members volunteered to form a Core Working Group that developed the bulk of the Standard for review by the TC.

2.2 Working methods and schedule

The TC held conventional plenary meetings that discussed the overall principles, requirements and detailed guidance to be incorporated in the Standard, and assigned tasks and reviewed the comments collected from the TC members, the industry and public reviews and CSA editors. The sections of the Standard were largely drafted and integrated by the Core Working Group. To reduce the time and financial expense for TC members who do not live near the CSA headquarters in Mississauga, Ontario, once the members knew each other well, many meetings were successfully held by teleconference using online Web collaboration tools. A few meetings were held at sites undergoing active decommissioning, to give the members of the TC direct contact with ongoing work and to allow them to set aside the distractions of their normal working environment. The Core Working Group held a drafting session at AECL's Whiteshell Laboratories at Pinawa, Manitoba, and the TC met at Cameco's facilities in Port Hope, Ontario.

Several adjustments had to be made to the fast-track schedule, but the TC and CSA staff managed to complete the necessary work to issue the first edition of the Standard by July 2009.

1) Owner/Operator/Producer		4) Service Industry	
New Brunswick Power	Lee DeLong (V)	Atomic Energy of Canada Limited	Stephen Kenny (V) Michael Attas (A) Dennis Allinson (A)
Ontario Power Generation	Cezar Georgescu (V)	SNC-Lavelin	Andrzej Krukowski (V)
Areva Resources	Arden Rosaasen (V) (succeeding Trevor Carlson)	EnergySolutions Canada	Tim Ryder (A)
Cameco	Doug Burgess (V)	CDV Project Mgmt	Charlene Vollrath (V)
Hydro-Quebec	Alain Phaneuf (A)		
2) Government/Regulatory Authority		5) General Interest	
Canadian Nuclear Safety Commission	Don Howard (Vice-chair)(V) Shirley Oue (A)	University Health Network	Ray Ilson (V)
Department of National Defence	Michael Walker (V), (succeeding Francis Allen)	University of Toronto	Sandu Sonoc (V)
Natural Resources Canada	Doug Metcalfe (V)		Anar Baweja (A)
3) Supplier/Fabricator/Contractor			Richard Ferch (V)
TLG Services	Geoff Griffiths (V)		Michael Stephens (Chair)(V)
Kinectrics	Mike Grey (V)		
AMEC NSS	Nihal Jayawardene (V)		
Nuclear Waste Management Organization	John Kennard(Vice-chair)(V)		

Table 1. Composition of TC on the Decommissioning of Nuclear Installations (April 2011).

2.3 Issues encountered in developing the Standard

The TC had to consider several fundamental issues before it could firmly define the scope of the Standard to be developed. For a start, the term "decommissioning" can be interpreted more or

less broadly depending on context, because both physical activities and administrative actions must be taken to retire a licensed facility and render it to a final state that will be acceptable in the long term. As well, while the same general principles are widely applied to manage nuclear facilities to be decommissioned, administrative processes do vary. For example, the moment when "final shutdown" of a facility ends and "decommissioning" begins is not universally agreed. Similarly, views differ on the extent to which "decommissioning" includes any institutional control that is needed to confirm that a decommissioning "final end state" has been achieved and is being maintained.

Decommissioning terminology used by different organizations, both national and international, varies. For example, CNSC guidelines [4] assign formal meanings to the terms "Preliminary Decommissioning Plan (PDP)" and "Detailed Decommissioning Plan (DDP)" for licensed activities, and impose specific requirements on their contents. However, in planning the decommissioning of less challenging buildings and structures AECL decommissioning groups prepare a "Shutdown and Decontamination Plan (SDP)" or "Building Removal Plan (BRP)", which are similar to, but simpler than a DDP. In decommissioning small facilities (e.g., a storage room for nuclear substances in a hospital), the detailed description of the planned work may be much simpler again. The TC introduced the generic terms "initial decommissioning plan" and "final decommissioning plan" to cover all the alternative situations.

The Canadian term "Storage with Surveillance" (i.e., the practice of keeping a facility to be decommissioned under controlled surveillance between sessions of active physical decommissioning work) is called "hotelling" in the United Kingdom. The United States terms "deactivation" of a shutdown facility to take it to a "Safe Store" state are not commonly used in Canada. To resolve terminology issues the TC referred to IAEA usage where appropriate, and defined the uniquely Canadian usages such as "nuclear substance" used by the CNSC in its requirements and regulations. Terminology used only by a single Canadian organization was not used.

Estimating the costs of decommissioning activities is well-recognized as challenging, and is itself an area of specialization. Estimates of decommissioning costs must be made early in the life cycle of a facility to plan the financial arrangements ensuring that adequate resources will be available when the eventual decommissioning takes place. Estimating decommissioning costs differs from estimating costs of constructing or operating a facility because decommissioning includes one-of activities and at various times, perhaps decades, in the future; allowances are needed to discount for future inflation, and for costs that will only be incurred later. Estimates must be made for contaminated facilities that may not yet have been well characterized, or that may become more contaminated in the course of future operation. The costs of managing the wastes generated by decommissioning can be substantial, and are sensitive to the volumes and classes of waste involved, and to changes in regulatory requirements. The uncertainty in a cost estimate may be stated in various ways, and the TC included two common schemes, the system of "grades" used for construction projects, and the "classes" used in process industries.

The TC considered whether to cover the processes involved in closing radioactive waste repositories and managing them in the long term. Many of the activities involved in removing surplus surface support facilities and sealing waste containment structures are similar to decommissioning of other nuclear facilities. However, the TC decided not to deal explicitly with

the final state of repositories, because they are expected to fulfill their design purpose in the long-term – they are thus not "retired" in the same sense as other facilities.

The TC had to decide what depth of detail to include on the specifics involved in dealing with particular structures and components in facilities (e.g., the primary coolant circuit pressure boundary in a power reactor). The TC decided not to attempt to cover in detail the many different possible technical issues that arise in decommissioning the various components of major nuclear facilities.

3. STRUCTURE AND CONTENT OF CSA N294-09

3.1 Structure and levels of stringency

N294-09 comprises a main text plus ten Annexes. The various items in the main text are specified in terms of several levels of stringency of requirement:

- "Shall" is used to express a requirement (i.e. a provision that the user is obliged to satisfy in order to comply with the Standard);
- "Should" expresses a recommendation that is advised, but not required;
- "May" expresses an option that is permissible within the limits of the standard;
- "Can" expresses possibility or capability.

All the Annexes are "informative", i.e., it is not mandatory to apply them to comply with the Standard.

3.2 Main text

The introductory clauses of the main text define the scope of the Standard, and list the documents it references, the definitions used, and general requirements on responsibilities in decommissioning activities. The core of the document describes decommissioning in terms of four phases: planning, preparation, execution and completion. The main ideas in each of these sections are summarized below.

3.2.1 Phase 1 – Planning for decommissioning

A decommissioning strategy (e.g., prompt decommissioning following shutdown, deferred decommissioning, or in-place entombment) should be developed even as a facility is being designed. Descriptive information should be collected throughout its life cycle: design, construction, commissioning, operation and maintenance, and final shutdown. An initial decommissioning plan should be developed as early as possible in the facility life cycle, and it should be periodically reviewed and updated.

Note: A Preliminary Decommissioning Plan, including a cost estimate and financial guarantee, must be prepared for a new licensed facility before the CNSC will issue a licence to prepare the site.

3.2.2 Phase 2 – Preparation for decommissioning

Preparation for decommissioning must include:

- Placing the shutdown facility into a safe shutdown state;
- Assessing the facility records and the state of the facility;

- Assessing the safety of the planned decommissioning;
- Performing an environmental assessment of the decommissioning (if required);
- Expanding the initial decommissioning plan into the final decommissioning plan (a Detailed Decommissioning Plan must be prepared for a licensed facility before the CNSC will issue a licence to decommission), including plans for managing the resulting waste and ensuring that sufficient human resources will be available to execute the decommissioning;
- Any additional requirements specified by the regulatory authority (i.e., CNSC or Director General Nuclear Safety).

3.2.3 Phase 3 – Execution of decommissioning

Physical decommissioning of a facility will include a variety of techniques to decontaminate and then dismantle or demolish equipment and structures. Numerous considerations are involved in selecting a decontamination method (e.g., whether the item is to be made suitable for reuse or treated as waste, the cost, degree of hazard to decommissioning workers, difficulty of execution, and need to demonstrate success of the process). Surveys of radiological and other hazards will be required before, during and after decommissioning to plan safety measures, monitor progress of the work, and demonstrate that goals have been achieved. A suite of support functions must be maintained during decommissioning. These may include (amongst others): conventional health and safety, radiation protection, criticality safety, waste management, security, quality assurance, and fire protection. If decommissioning is completed in a series of steps, a report must be prepared on the condition of the facility each time that active decommissioning ceases and a plan prepared and implemented to maintain the facility in a safe, controlled state until the next decommissioning activities start.

3.2.4 Phase 4 – Completion of decommissioning

Decommissioning is considered complete when the intended final end state of the facility has been achieved, demonstrated, and documented, any remaining risks meet regulatory requirements, and the facility has been released from regulatory control.

3.2.5 Institutional controls following decommissioning

Although not considered part of decommissioning, institutional controls may be required as a necessary safety measure, or to enhance confidence in the continuing safety of the site. It is recommended that decommissioning strategy should not rely on long-term institutional controls as a safety measure unless they are unavoidable (e.g., for surface impoundments for tailings). Institutional controls may involve restricting allowed uses of a site, filing records of site history with the controlling institution, continuing surveillance, or active measures such as operational control systems. If active institutional controls are required, measures should be taken to minimize the required time period and the extent of the controls, where practicable.

3.2.6 Decommissioning records

Numerous records must be retained describing the execution of the decommissioning and the results achieved. The retention period for decommissioning records depends on the type and complexity of the decommissioning project, and can be affected by factors other than regulatory requirements (e.g., legal requirements).

3.3 Annexes

Ten informative (non-mandatory) annexes provide supplementary information on selected aspects of decommissioning.

3.3.1 Annex A - Preliminary decommissioning plan

Annex A specifies the considerations to be included in developing a PDP for a nuclear facility regulated by the CNSC. It may be used for other facilities, as applicable and suitable.

3.3.2 Annex B - Financial aspects of decommissioning nuclear facilities

Annex B addresses the principal financial considerations associated with the decommissioning of nuclear facilities. Financial arrangements are needed to provide assurance that adequate resources will be available to fund decommissioning activities.

3.3.3 Annex C – Surveys

Surveys are conducted throughout decommissioning to assist in planning, executing and demonstrating successful completion of decommissioning. Annex C describes a systematic planning process based on the data quality objectives process developed by the United States Environmental Protection Agency.

3.3.4 Annex D - Final end state report

Annex D recommends contents to be included in the report describing the final end state achieved by decommissioning. The report should review the completed decommissioning process, noting any significant deviations from the final decommissioning plan, document that the planned end state conditions have been met, and describe any further institutional controls to be put into place.

3.3.5 Annex E - Recommended approaches for the decommissioning of mine waste rock and mill tailings

Annex E addresses special considerations when decommissioning uranium mines and milling sites. It discusses the long-term institutional control of facilities that involve decommissioning tailings and waste rock.

3.3.6 Annex F - Decommissioning of complex sites

Sites containing several nuclear facilities and the related infrastructure present special challenges. It may not be possible or desirable to decommission everything at the same time (e.g., due to financial or human resource constraints). Prioritization of all the required decommissioning activities may lead to prompt decommissioning of some facilities and deferred decommissioning of lower priority facilities. Decommissioning of shutdown facilities interspersed with operating facilities can present specific challenges due to their close proximity and shared common services. Communications with potential stakeholders may be more extensive and demanding than for simpler sites.

3.3.7 Annex G - Decommissioning of small facilities (other than Class I or Class II)

Annex G deals with decommissioning activities associated with small facilities that are not considered to be nuclear facilities, but in which nuclear substances have been used and which require decommissioning. Decommissioning of small facilities requires applying the same

principles as for nuclear facilities, but planning, implementation and documentation can be carried out more simply.

3.3.8 Annex H – End state dose objectives for decommissioning

Decommissioning end states are commonly agreed upon with the regulatory authority before planning activities for decommissioning are initiated. The end state is defined in part by setting an end state objective that will protect the health of the general public and the environment after decommissioning is completed. Annex H provides examples of dose objectives that have been used for decommissioning and environmental remediation activities.

3.3.9 Annex I - Planning for decommissioning throughout the life cycle of the facility

Planning for the eventual decommissioning of a facility should be an integral part of the life-cycle planning of the facility. Annex I outlines recommended measures and records to generate and retain to support decommissioning during siting, design and construction, commissioning, operation and maintenance, final shutdown, and decommissioning of a facility.

3.3.10 Annex J - Bibliography

Annex J contains a substantial bibliography of useful decommissioning documents from Canadian, foreign and international sources. The compilation was funded by the CNSC to support development of the Standard. It serves as a guide to where more detailed information is available on specific topics.

4. CURRENT STATUS OF CSA N294-09 AND FUTURE DEVELOPMENTS

4.1 Implementation of CSA N294-09 through CNSC licences and oversight

N294-09 is now available for use and inclusion in the provisions governing activities regulated by the CNSC and the DGNS. This is commonly done by the licensee including a reference to the N294-09 standard in its application for a licence, and by the CNSC in either the licence it issues, or in a handbook accompanying the licence.

4.2 TC currently in maintenance mode

Now that N294-09 has been issued in English and French versions, the TC is now operating in "maintenance" mode. The TC meets bi-annually to review issues and the status of the document.

Users of N294-09 can submit enquiries to CSA, including Requests for Interpretation (RFI), if they encounter difficulties in understanding its provisions when evaluating whether and how to apply them in their situation. More information on RFIs can be found in the preface of the Standard.

4.3 Planned improvements

All CSA Standards are subject to review for reaffirmation or revision every five years; accordingly, N294-09 will be reviewed for reaffirmation or revision in 2014. Amendments can be made or a new edition can be issued earlier, if necessary. The TC is currently considering covering several issues more thoroughly in future editions of the Standard, including:

- The scope and timing of Detailed Decommissioning Plans to decommission a multi-reactor nuclear generating station in a sequence of steps for different parts of the site;

- Clarification of provisions for managing shutdown facilities during periods of Storage With Surveillance between projects that advance the facility from one decommissioning end state to the next;
- Minor corrections and clarifications to the English version that were identified when the document was translated into French.

5. SUMMARY

Canadian Standards Association released the first edition of the N294 Standard, *Decommissioning of facilities containing nuclear substances,* in English in 2009 July and in French in 2011 January. The Standard provides direction to groups in Canada that are decommissioning facilities and sites that have been used for activities involving nuclear substances. The Standard is intended to be consistent with Canadian and international recommendations. It also incorporates current best practices and existing regulatory requirements, and draws on the decommissioning experience of the Canadian nuclear industry.

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The Standard describes requirements and guidelines for the detailed decommissioning process in terms of four phases: planning, preparation, execution and completion. Annexes provide guidance on specific aspects of decommissioning, including: preparing preliminary decommissioning plans, estimating decommissioning costs, conducting surveys and preparing end state reports, and on handling particular situations such as decommissioning mine waste rock and tailings, complex sites, and small facilities.

The Standard is now beginning to be applied through the site licences and associated handbooks issued by the CNSC. It will continue to be improved as experience accumulates.

ACKNOWLEDGEMENTS

The N294-09 Standard was developed by a CSA Technical Committee that comprises formally balanced representation from all the stakeholder groups. The time and expenses of the majority of the participants were funded by the organizations they represent, and the remaining costs were covered by CSA through the organizations that voluntarily contribute funding to this national standards development organization.

The presenter gratefully acknowledges the continuing contributions of the members of the TC over several years in creating and maintaining the Standard. The CSA Project Managers assigned to this Standard and CSA itself have provided excellent support since the inception of this work, which is much appreciated by the TC.

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