Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

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CMD: 18-M11

Date signed/Signé le : 01 MARCH 2018

Publish Regulatory Document	Publier le document d'application de la réglementation
REGDOC-2.1.2, *Safety Culture*	**REGDOC-2.1.2, *Culture de sûreté***
Public Meeting	Réunion publique
Scheduled for: 15 March 2018	Prévue pour : 15 mars 2018
Submitted by: CNSC Staff	Soumise par : Le personnel de la CCSN

e-Doc 5398273 (WORD)
e-Doc 5470997 (PDF)

Canada

Summary

This CMD pertains to a request for a decision regarding:

- regulatory document REGDOC-2.1.2, *Safety Culture*

The following action is requested of the Commission:

- publish REGDOC-2.1.2, *Safety Culture*

The following items are attached:

- REGDOC-2.1.2, *Safety Culture* (e-Doc 4981758)
- REGDOC-2.1.2, *Culture de sûreté* (e-Doc 5052598)
- Consultation Report (e-Doc 5389855)
- Public Consultation Comments Table (e-Doc 5101646)
- Discussion Paper DIS-12-07, *Safety Culture for nuclear licensees* (e-Doc 4407294)
- What We Heard Report DIS-12-07 (e-Doc 4479559)

Résumé

Le présent CMD concerne une demande de décision au sujet de :

- document d'application de la réglementation REGDOC-2.1.2, *Culture de sûreté*

La Commission pourrait considérer prendre la mesure suivante :

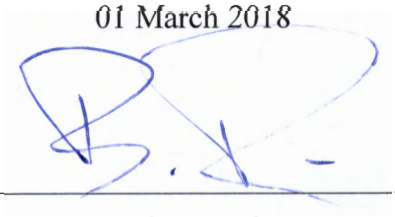
- publier REGDOC-2.1.2, *Culture de sûreté*

Les pièces suivantes sont jointes :

- REGDOC-2.1.2, *Safety Culture* (e-Doc 4981758)
- REGDOC- REGDOC-2.1.2, *Culture de sûreté* (e-Doc 5052598)
- Rapport de consultation (e-Doc 5389855)
- Tableau des réponses aux commentaires reçus (e-Doc 5101646)
- Document de travail DIS-12-07, Culture de sûreté chez les titulaires de permis nucléaires (e-Doc 3996935)
- Rapport sur ce que nous avons entendu (4219983)

Signed/signé le

01 March 2018



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Director General

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EXECUTIVE SUMMARY

The CNSC defines safety culture as the characteristics of the work environment, such as the values, rules, and common understandings that influence workers' perceptions and attitudes about the importance that the organization places on safety. This definition is aligned with others being used in the nuclear industry, sharing common elements and overall goals. The approach is holistic, and not restricted to only occupational health and safety.

Experience in the international nuclear industry and in other industries has demonstrated the importance of a healthy safety culture in maintaining the safety of workers, the public and the environment. Accident inquiries both within the nuclear industry (such as Chernobyl and Fukushima) and outside the nuclear industry (such as DeepWater Horizon and Lac Mégantic) have all identified safety culture as one causal factor implicated in allowing the catastrophe to happen. Equivalently, more focus on safety culture is a preventive measure that identifies and helps change practices and beliefs that would otherwise be consistent with those found in accident inquiries.

CNSC's path forward to promoting a heathy safety culture across the Canadian nuclear industry is by developing a regulatory policy on safety culture. This REGDOC is a means to accomplish that objective.

CNSC staff has undergone an intensive literature review and proceeded to benchmark national and international practices on safety culture to justify this REGDOC's approach. As a result, two appendices have been included in this document: Appendix A, Rationale of security culture inclusion and Appendix B, Synopsis from Science and Benchmarking supporting REGDOC-2.1.2, *Safety Culture*.

REGDOC-2.1.2, *Safety Culture*, sets requirements and guidance for Class I licensees and uranium mines and mills. For these licensees as well as Class II and nuclear substances licensees, REGDOC-2.1.2 contains information to help them learn more about their organizations' safety culture. REGDOC-2.1.2 provides more specific requirements and guidance related to safety culture, as an elaboration on the management system requirements contained in the CSA standard CSA N286, *Management system requirements for nuclear facilities*.

If REGDOC-2.1.2 is published, CNSC staff anticipate Class I nuclear facilities and uranium mines and mills licensees may have to modify existing safety culture assessment and improvement tools. Those licensees would need to integrate safety and security culture into ongoing monitoring activities and work to continually improve safety culture assessment methods.

There will be no regulatory impact on Class II and nuclear substances licensees as the requirements in the document do not apply. However, guidance and information are included in the REGDOC to help these licensees learn more about safety culture.

Extensive consultation has been done with this REGDOC. CNSC staff engaged in an ongoing exchange with stakeholders since 2012: public consultations on Discussion Paper and draft REGDOC, two distinct workshops, email correspondence, etc. As a result, significant changes have been made to the document.

The attached summary consultation report presents the key comments received and the CNSC's responses, and the attached Public Consultation Comments Table provides all comments received.

1 OVERVIEW

1.1 Background

A healthy safety culture is a key factor in reducing the likelihood of safety-related events and mitigating their potential impact, and in continually improving safety performance. All workers, from senior managers downwards, have a shared responsibility to ensure that a healthy safety culture is a priority.

REGDOC-2.1.2 is a result of two decades of work beginning with the development and application of an assessment method and the publication of a discussion paper. CNSC's path forward to promoting a heathy safety culture across the Canadian nuclear industry is by developing a regulatory policy on safety culture. This REGDOC is a means to accomplish that objective.

The term safety culture is standard terminology in many industries outside the nuclear industry. While the CNSC acknowledges that many definitions of safety culture exist, the CNSC defines safety culture as the characteristics of the work environment, such as the values, rules, and common understandings that influence workers' perceptions and attitudes about the importance that the organization places on safety. This definition has been used by the CNSC for the past 30-plus years and is aligned with others being used in the nuclear industry, sharing common elements and overall goals. (See Appendix B, Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2, *Safety Culture*, section 1.3)

Over the past few decades, experience in the international nuclear industry and other industries has demonstrated the importance of a healthy safety culture in maintaining the safety of workers, the public, and the environment.

While the term safety culture has been around since the Chernobyl disaster, some recent catastrophes, both in and outside the nuclear industry, have highlighted deficiencies in safety culture in the analysts' accident reports. Prior to the 2010 disaster at DeepWater Horizon's offshore oil rig, stellar scores in occupational health and safety had given the organization the false perception that system safety and safety culture were equally as stellar (Deepwater Horizon Study Group, 2011, p. 9). In Canada, the investigation into the 2013 Lac Mégantic rail disaster identified many aspects of safety culture that were deficient or absent (TSB, 2014, p. 7). In the nuclear industry, since Chernobyl (1986), there has been a significant near miss at the Davis Besse nuclear plant in the US (2002), which encouraged the Institute for Nuclear Power Operations to establish a framework for safety culture (INPO, 2004). More recently, the accident at Japan's Fukushima Daiichi nuclear power plant in 2011 highlighted safety culture issues not only at the plant (Director General, 2015) but also at the regulatory body (Director General, 2015). Overall, safety culture has become increasingly important to operating entities and regulators.

Security Culture

Canada is a signatory to the *Amendment to the Convention on the Physical Protection of Nuclear Material*, which obliges member states to apply all Fundamental Principles described therein. One of these concerns security culture.

The CNSC defines security culture as the characteristics of the work environment, such as the values, rules, and common understandings that influence workers' perceptions and attitudes about the importance that the organization places on security.

In REGDOC-2.1.2, safety culture and security culture coexist through the shared common objective of limiting risk, and they share common goals and techniques for promotion and monitoring activities. In this document, "safety culture" denotes safety culture and security culture collectively, except where a distinction is made. There are only a few key differences in security culture indicators as compared to safety culture indicators in Appendix A of REGDOC-2.1.2. Moreover, it is critical for a nuclear organization to fully understand the interface between safety and security and the potential consequences of one sphere interfering with the other. Appendix A, Rationale of security culture inclusion, presents policy type evidence of Canada's Obligations and Positions and International Community Positions, as well as research evidence from the scientific literature outlining both the analysis of safety and security integration and brief treatment of the practices of this integration, justifying that safety culture should also include security culture.

The safety culture self-assessment process as laid out in the REGDOC for nuclear power plants (NPP) can equally be applied to security culture, and while a majority of the safety culture reference framework presented in Appendix A of the REGDOC applies to both, licensees are free to assess their safety and security cultures jointly or separately; this is specifically indicated in the proposed REGDOC.

1.2 Highlights

REGDOC-2.1.2, *Safety Culture*, provides greater detail and clarity to licensees and applicants on how to meet the requirements related to fostering, assessing and monitoring a healthy safety culture. Specifically the document:

- clearly documents CNSC regulatory expectations in this area, establishes a common understanding of what constitutes a healthy safety culture and the importance of fostering safety culture in a licensee's organization
- makes the standards and expectations the Canadian nuclear industry must meet related to safety culture transparent for the Canadian public and international community
- applies a graded approach (i.e., the application of requirements is commensurate with the risks and particular characteristics of the facility or activity) and provides clear and explicit information to all existing and potential licensees on what requirements or guidance is applicable

Appendix B, Synopsis from Science and Benchmarking presents a literature review and the results benchmarking (both inside and outside the nuclear field) of current practices on safety culture. The literature reviewed, which included seminal works, literature reviews of safety culture, and many industry specific reports, demonstrate that REGDOC-2.1.2 is consistent with national and international practices.

2 CONSULTATION

Stakeholders were extensively consulted throughout the REGDOC development process from the initial Discussion Paper through to the current draft presented to the Commission to publish.

In keeping with its commitment to stakeholder engagement, the CNSC consults with stakeholders prior to and during the development of a regulatory document. The following sections detail two consultation phases for this project which occurred over a five year period from 2012 to 2017.

Phase I: September 2012 to February 2013 – Discussion Paper 12-07

Engagement on the safety culture project began in 2012 with the publication of discussion paper DIS-12-07, *Safety culture for nuclear licensees*. The CNSC issued this discussion paper for public comment on September 5, 2012 for a 128-day comment period. The discussion paper sought input from stakeholders and the general public. On January 29, 2013 the CNSC posted the comments it received on its website, and issued an invitation to provide feedback for a 14-day period. The CNSC received a total of 17 submissions from stakeholders over the course of both comment periods.

CNSC staff considered all comments received during the public consultation on DIS-12-03 and published a *What We Heard Report*, which provided a summary of the comments. There was general support for the safety culture initiative and some concerns raised with issues such as the application of a graded approach and the need to ensure flexibility for licensees.

The report also indicated that the CNSC was embarking on the development of a safety culture regulatory document to detail requirements and guidance in support of licensees' fostering a healthy safety culture in their respective organisations. The REGDOC promised to clarify the language associated with safety culture and to provide a degree of flexibility, allowing licensees to adapt the guidance to their own needs.

The CNSC also pledged to engage licensees on the topic of safety culture to communicate the proposed graded approach that would be applicable to the different types of licensees.

Feedback received on DIS-12-07 was considered and was used in the creation of the public consultation draft of REGDOC-2.1.2, *Safety Culture*.

Phase II: September 2016 to June 2017 public consultation on draft REGDOC-2.1.2*, Safety Culture*

An overview of key comment themes and CNSC staff responses is provided in the attached Consultation Report. These are also summarized in the Key Comments section below. The full details of the comments submitted and the CNSC staff responses are provided in the attached Public Consultation Comments Table.

The CNSC engaged stakeholders throughout the development of REGDOC-2.1.2. Public consultation on the draft REGDOC was held from September 2016 to April 2017 (including feedback on comments). During the consultation period, in January 2017, a

stakeholder workshop was held to discuss clarification issues in the draft REGDOC. Issues discussed at the workshop were formally submitted as per normal public consultation practice.

During the consultation period the CNSC received 169 comments from 13 respondents: Areva, Bruce Power, Cameco Corporation, Canadian Nuclear Association, Canadian Nuclear Laboratories, Canadian Nuclear Workers' Council, New Brunswick Power, Nordion, Ontario Power Generation, Power Workers' Union, SNC-Lavalin Nuclear Inc., J. Froats (University of Ontario Institute of Technology professor and COG safety culture trainer) and Winnipeg Regional Health Authority. The comments received were added to the Public Consultation Comments Table. The text in draft REGDOC-2.1.2 has been revised to address the intent of the comments as appropriate – see Table 1.

Following the public consultation period, submissions from respondents were posted on the CNSC's website from March 23 to April 6, 2017 for feedback on the comments received. No additional comments were received.

As a result of initial public comments key modifications were made to the document including further clarifying the scope of the document, rescinding requirements to submit final summary reports to the CNSC and refocussing communications guidance to focus on internal communications rather than with external stakeholders.

The CNSC held a second workshop, with stakeholders who commented on REGDOC-2.1.2, on June 27-28, 2017. The workshop provided an opportunity to discuss and clarify comments received, and further improve the clarity of the draft regulatory document. During the workshop, bulleted "What We Heard" slides were developed and agreed upon by participants. Subsequently, the individual bullets from these slides were entered into the Public Consultation Comments Table.

Through the June workshop a better understanding of key issues between the CNSC and stakeholders was achieved. For example, stakeholders raised concerns about the terminology, which they found to be excessively prescriptive, whereas subjective considerations are integral to assessing the health of an organization's safety culture. CNSC staff agrees that qualitative techniques and terminology are important in any assessment of a healthy safety culture – managers and staff should feel comfortable in articulating their views on their organization's safety culture without feeling constrained by an overly-rigid or technical approach. Furthermore, staff agree that safety culture overall is not something that can or should be quantified in the sense of assigning a numerical value. However, it is still important to recognize the need for some degree of rigor when gathering and analyzing data in a safety culture assessment. Based on this position, CNSC staff have amended the REGDOC in an attempt to achieve the right balance between the quantitative and qualitative elements of a safety culture assessment by using the terms 'comprehensive', 'systematic' and 'rigorous' to characterize the requirement to conduct an assessment.

Differences of stakeholder opinion also emerged when it came to an appendix in the draft REGDOC providing a general overview of how a healthy safety culture evolves within an organization and criteria to help organizations determine the stage at which the organization resided. Large licensees commented that the inclusion of the criteria created a second safety culture framework within the document and that it would, therefore, lead

to regulatory confusion. In contrast, nuclear substance and other smaller licensees appreciated the explanations provided, found the criteria helpful and requested that it be maintained.

As a result of discussions CNSC staff split the original appendix in the REGDOC into two components. The second component containing the evolutionary criteria indicators was described as providing information for Class II and Nuclear Substances licensees.

An email containing the revised REGDOC was sent to all who participated in the public consultation process on November 30, 2017. An additional 26 comments were received from COG and John Froats (University of Ontario Institute of Technology professor and COG safety culture trainer), which have been added to the Public Consultation Comments Table.

Key Comments

- Class II and nuclear substances licensees stakeholders requested the CNSC add clarity to the scope of the document, in designating which requirements and guidance apply to which licensees.

  CNSC staff acknowledged the concerns expressed by licensees regarding the applicability of requirements and guidance to various licensees. In response to comments, the REGDOC was modified to include clear statements in each requirements section about which requirements and guidance applied to which licensees.

- Stakeholders raised concerns over the existence of multiple "safety culture" definitions and associated frameworks.

  The REGDOC maintains the CNSC definition of "safety culture". The CNSC's definition was a result of thorough research and discussions on safety culture and has been used since the 90's (See Appendix B, Synopsis from Science and Benchmarking-sections 1.3 and 2) All the safety culture definitions highlight similar elements and have similar goals. Minor variations in the definitions of the WANO/INPO, IAEA and the CNSC do not affect requirements.

  While the REGDOC maintains the CNSC definition, it was made clear to stakeholders that they have the flexibility to use whatever recognized definition suits the organizational needs. See Appendix B, Synopsis from Science and Benchmarking-section 1 for more information and benchmarking on the importance of safety culture and section 1.3 for safety culture definitions.

  The safety culture reference framework was modified in the REGDOC in response to stakeholder comments. In addition, licensees can use their own frameworks, the requirement is that they must be mapped to the CNSC safety culture reference framework; this would be a one-time exercise. See Appendix B, Synopsis from Science and Benchmarking-section 8 for more information and benchmarking on safety culture frameworks.

- The stakeholders also disagreed with the inclusion of security culture being integrated to safety culture. They find that security culture is not as mature as safety culture, which industry has been developing for decades. Multiple methodologies have been

developed for safety culture, but no guidance has been published yet for security culture.

The REGDOC was revised to acknowledge the fact that security culture is less mature than safety culture, but that it serves the same objective as safety culture: to limit the risk resulting from nuclear substances and associated facilities. Considering all aspects together enables a higher assurance that the balance between safety and security will be considered. See Appendix A, Inclusion of Security Culture for the rationale for why security culture should be in this REGDOC at this juncture.

- Stakeholders raised the following key concerns about safety culture self-assessments:
  i. the requirements to conduct safety culture assessments that were "empirical, valid, practical, and functional" was viewed as too prescriptive and as placing too much emphasis on quantitative data
  ii. the requirements to report on assessment outside the organization could cause a 'chilling effect' on employee responses
  iii. the requirement to conduct assessments every three years was viewed as too frequent.

CNSC staff acknowledged concerns and made the following changes to the draft REGDOC:

i. CNSC staff agree that qualitative methods and terminology are important in any assessment of a healthy safety culture – managers and staff should feel comfortable in articulating their views on their organization's safety culture without feeling constrained by an overly-rigid or technical approach. Furthermore, staff agree that safety culture overall is not something that can or should be quantified in the sense of assigning a numerical value or score. However, it is still important to recognize the need for some degree of empirical methods when gathering and analyzing data in a safety culture assessment. See Appendix B, Synopsis from Science and Benchmarking sections 6 and 7 for more information and benchmarking on safety culture assessments.

   In order to better capture this balance between qualitative and quantitative elements, the requirement language in the REGDOC for the conduct of safety culture assessments was revised to reflect terms discussed during the June 2017 stakeholder workshop. The requirement uses less prescriptive terms: "comprehensive, systematic and rigorous".

ii. The requirement to submit summary reports to the CNSC was removed from the REGDOC. As well, the communications strategy was changed to focus on internal communications, and all references to external communications were removed.

   To ensure that the removal of this requirement does not impact CNSC staff's regulatory oversight, emphasis was put on record keeping. Therefore, CNSC staff can access all the records on the licensee's safety culture self-assessment on site during an inspection, upon request.

iii. The frequency of performing a safety culture assessment has been changed from three to five years, with guidance that they should be carried out as operational needs dictate, e.g. new ownership, governance, structure, responsibilities or new activities such as refurbishment, decommissioning, etc. The five years frequency allows more flexibility for stakeholders to perform their self-assessment, analyse and document the results and implement the improvement plan.

- Stakeholder positions on the inclusion of the Maturity Model as shown in Appendix B in the REGDOC of the consultation draft of the REGDOC were divided. Non-NPP stakeholders found that it was helpful and valuable. NPP licensees found the maturity model to be unclear. They were especially concerned with the inclusion of specific indicators which they understood to have created a second safety culture reference framework. NPP licensees were unsure how the CNSC would expect them to make use of the Maturity Model. They questioned the added value of having the maturity model in the REGDOC and suggested it be removed from the REGDOC.

  The Maturity Model remains in the REGDOC as it does not contain requirements, and provides useful information to licensees that are less familiar with safety culture. However, the model was modified. The specific indicators that describe behaviours related to the three stages of maturity of an organization's safety culture were separated to become Appendix C. The REGDOC states that the Appendix C indicators are to provide information specifically for Class II and nuclear substances licensees.

  The IAEA has been developing guidance on maturity models since the 1990s and industries such as oil and gas, aviation, healthcare, rail and public transportation have used maturity models to develop and evolve their safety cultures. See Appendix B, Synopsis from Science and Benchmarking-section 9 for more information and benchmarking on maturity models.

3 IMPLEMENTATION

Should the Commission decide to publish of this document, REGDOC-2.1.2, Safety Culture will be published on the CNSC website and made available to licensees and stakeholders.

REGDOC-2.1.2 is intended to form part of the licensing basis for Class I nuclear facilities and uranium mines and mills and will be incorporated into the Licence Conditions Handbook (LCH) for each applicable licensee. The LCH also captures implementation plans and timelines that are reviewed and accepted by CNSC staff.

If REGDOC-2.1.2 is published, CNSC staff anticipate Class I nuclear facilities and uranium mines and mills licensees may have to modify existing safety culture assessment and improvement tools. Those licensees would need to integrate safety and security culture into ongoing monitoring activities and work to continually improve safety culture assessment methods.

There will be no regulatory impact on Class II and nuclear substances licensees as the requirements in the document do not apply. However, guidance and information are included in the REGDOC to help these licensees learn more about safety culture.

4 OVERALL CONCLUSIONS AND RECOMMENDATIONS

4.1 Overall Conclusions

This REGDOC had extensive consultation which drove changes to the document, addressing a large number of licensees with sometimes diverging positions. This REGDOC is also supported by several decades of experience and technical basis documentation.

The literature and benchmarking (both inside and outside the nuclear field) included in Appendix B, Synopsis from Science and Benchmarking supports the approach taken by the CNSC in REGDOC-2.1.2 *Safety Culture*. REGDOC-2.1.2 is consistent with the literature reviewed, which included seminal works, literature reviews of safety culture, and many industry specific reports, and hence the approach taken in REGDOC-2.1.2, *Safety Culture* is scientifically sound, and reasonable.

CNSC staff conclude that draft REGDOC-2.1.2, Safety Culture, is ready for the Commission to make its decision to publish.

4.2 Overall Recommendations

CNSC staff recommend that the Commission publish REGDOC-2.1.2, *Safety Culture*.

REFERENCES

International Atomic Energy Agency. (2016). *Safety Report Series 83: Performing safety culture self-assessments*. STI/PUB/1682

Deepwater Horizon Study Group. (2011). *Final Report on the Investigation of the Macondo Well Blowout.* Univesity fo California, Berkley: Center for Catastrophic Risk Management

Director General. (2015, e-Doc 4764501). *GOV/2015/26 - The Fukushima Daiichi Accident.* Vienna: IAEA. P. 7-8

INPO. (2004, e-Doc 5435459). *Principles for a Strong Nuclear Safety Culture.* Atlanta, Georgia: Institute for Nuclear Power Operators. P. ii

TSB. (2014). *Cat. No. TU4-25/1-2014E Lac-Mégantic runaway train and derailment investigation summary.* Gatineau P.Q.: Transportation Safety Board.

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APPENDIX A. RATIONALE FOR SECURITY CULTURE INCLUSION IN THE REGDOC-2.1.2, *SAFETY CULTURE*

Contents

Introduction

In the consultation of REGDOC-2.1.2, stakeholders commented that the inclusion of security culture in the REGDOC at this time was premature, and undesired. The goal of this appendix is to answer the question: Should REGDOC-2.1.2 Safety Culture include security culture?

Policy is often informed by many sources other than a research basis (Galea, 2013), and this can cause problems for practitioners (Demeter, 2016). This appendix attempts to cover the research informed aspect, as well as influences from other sources. The format of this appendix is as follows: to explain the policy evidence first in Canada's Obligations and Positions, followed by the International Community Positions. The research evidence is then presented regarding the Analysis of Safety and Security Integration followed by brief section on select Practices of Safety and Security Integration.

Acronyms

CBRN – Chemical, Biological, Radiological, Nuclear
CPPNM - Convention on the Physical Protection of Nuclear Material
CPPNM/A - Amendment to the Convention on the Physical Protection of Nuclear Material
CSA – Canadian Standards Association
ENSI – Eidgenossenschaft Scweizerische (Swiss Federal Nuclear Safety Inspectorate)
GNSSN - Global Nuclear Safety and Security Network
IAEA - International Atomic Energy Agency
INPO – Institute of Nuclear Power Operators
INSAG – International Nuclear Safety Advisory Group
IPPAS - International Physical Protection Advisory Service
MAP - Management Action Plan
NATO - North Atlantic Treaty Organization
NPP – Nuclear Power Plant
NRC - Nuclear Regulatory Commission
NSGC - Nuclear Security Guidance Committee
NSS – Nuclear Security Series
ORAU - consortium of major Ph.D. granting academic institutions
REGDOC – Regulatory Document
RM – Review Meeting
SF – Safety Fundamentals
SME – Subject Matter Expert
SMS/SeMS - A safety/security management system
TECDOC – Technical Document
UK – United Kingdom
US – United States
WANO - World Association of Nuclear Operators
WINS - World Institute of Nuclear Security

1. Canada's Obligations and Positions

Canada as a country has signed on to or espoused the importance of security and security culture in various fora. Presented below are these various commitments and positions.

1.1 Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM/A)

The Convention on the Physical Protection of Nuclear Material (CPPNM/A) which Canada ratified December 3, 2013 establishes obligations on member states to establish physical protection regimes. In implementing the obligations, each state party to the convention shall apply the fundamental principles in the amendment. This includes the following fundamental principle:

> Fundamental Principle F: Security Culture
> All organizations involved in implementing physical protection should give due priority to the security culture, to its development and maintenance necessary to ensure its effective implementation in the entire organization. (IAEA, Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM/A), 2016, p. 5)

As such, all signatories are obliged to address all the fundamental principles in the convention, including Principle F, Security Culture. Including security culture in REGDOC-2.1.2 Safety Culture would address this commitment.

1.2 International Physical Protection Advisory Service (IPPAS) Mission

> The International Physical Protection Advisory Service (IPPAS) was established by IAEA in 1995 and is a fundamental part of the IAEA's efforts to assist States, on request, to establish and maintain an effective national nuclear security regime to protect against the unauthorized removal of nuclear and other radioactive material and against the sabotage of nuclear and other associated facilities, as well as material during transport while recognizing that the ultimate responsibility for physical protection lies with the Member State.
> IPPAS provides peer review on implementing relevant international instruments, in particular the Convention on the Physical Protection of Nuclear Material (CPPNM), together with its 2005 Amendment, and on implementing the IAEA Nuclear Security Series, in particular the Fundamentals and Recommendations.
> The October 2015 IAEA IPPAS mission to Canada was highly successful, and IAEA delegates noted in their final report that Canada has a "mature and robust nuclear security regime". The report included three (3) recommendations, thirty (30) suggestions, and twenty-one (21) good practices. CNSC has elected to address the recommendations and suggestions through the Harmonized Plan Steering Committee. A formal IPPAS Management Action Plan (MAP) was approved and findings were assigned to CNSC Subject Matter Expert (SME) for action. Good practices will be shared with various stakeholders but will not be

> addressed in the MAP. (Directorate of Security and Safeguards, 2015 IPPAS Mission Management Action Plan, 2016, 2-3)
> In the IPPAS Mission Management Action Plan, Four Findings and Suggestions dealt specifically with security culture. All cited material below originates from (Directorate of Security and Safeguards, International Physical Protection Advisory Service (IPPAS) to Canada 2015 Post Mission Management Action Plan (MAP), Annex A, 2016).

Namely,

- The CNSC should consider the enhancement of policies and processes which elevate the relative importance of security to ensure it equates with that of safety. (Finding #2, Suggestion #2).
- The CNSC should consider using the development of its Management System Safety Culture document as an opportunity to explicitly refer to nuclear security culture and its importance. Useful guidance can be found in IAEA NSS No.7.(Finding #12, Suggestion #7)
- To further promote the importance of Nuclear Security Culture, the licensee should consider formally enshrining its importance by explicitly referring to nuclear security culture, e.g. in values of Code of Conduct. (Finding #20, Suggestion #10; Finding #30, Suggestion #17)

The formal response to all these findings and suggestions is

> "CNSC is developing REGDOC-2.1.2 Safety Culture that will incorporate safety and security culture. This document will address this suggestion."

As such, the CNSC has already formally committed to including security culture in REGDOC-2.1.2 Safety Culture.

1.3 Convention on Nuclear Safety

> The 7th review meeting (RM) of the Convention on Nuclear Safety (CNS) took place in 2017. The background of the convention (taken from the IAEA website https://www-ns.iaea.org/conventions/nuclear-safety.asp?s=6&l=41) is as follows:
> The Convention on Nuclear Safety was adopted in Vienna on 17 June 1994. The Convention was drawn up during a series of expert level meetings from 1992 to 1994 and was the result of considerable work by Governments, national nuclear safety authorities and the Agency's Secretariat. Its aim is to legally commit participating States operating land-based nuclear power plants to maintain a high level of safety by setting international benchmarks to which States would subscribe.
> The obligations of the Parties are based to a large extent on the principles contained in the IAEA Safety Fundamentals document "Fundamental Safety Principles (SF-1)". These obligations cover for instance, siting, design, construction, operation, the availability of adequate financial and human resources, the assessment and verification of safety, quality assurance and emergency preparedness.

> The Convention is based on Parties' common interest to achieve higher levels of safety which will be developed and promoted through regular meetings. The Convention obliges Parties to submit reports on the implementation of their obligations for "peer review" at meetings of the Parties to be held at the IAEA. This mechanism is the main innovative and dynamic element of the Convention.

In Canada's report, safety and security culture were jointly mentioned. Through the peer review process of the 7th RM CNSC staff learned that this was also the case for other NPP countries (Belgium, India, South Africa). Some non NPP countries (Tunisia, Tukey and the United Arab Emirates) also mentioned safety and security culture jointly in their Convention on Nuclear Safety 7th review meeting reports.

The mention of security culture jointly with safety culture was seen at the 7th RM of the CNS, and is commensurate with the inclusion of security culture in REGDOC-2.1.2 Safety Culture.

1.4 Canadian Nuclear Safety Commission Executive

(taken from the CNSC website)

On June 5, 2017, Jason Cameron, CNSC Vice-President and Chief Communications Officer, delivered a presentation on behalf of Ramzi Jammal at the 37th Annual Conference of the Canadian Nuclear Society in Niagara Falls, Ontario. The presentation, titled "The Canadian Approach to Effective Safety and Security Interfacing", discusses the importance placed on safety and security interfaces in Canada while recognizing the societal benefits arising from the safe and secure use of sealed sources. Mr. Cameron also highlights Canadian good practices that were identified by the International Atomic Energy Agency during a recent International Physical Protection Advisory Service mission.

Specifically, on a slide entitled "Fostering Safety/Security Interfaces", a bullet reads "Fostering of an inclusive culture of safety and security" (Cameron, 2017, p. 8).

This is entirely consistent with the approach CNSC staff has taken with REGDOC-2.1.2.

2.0 INTERNATIONAL COMMUNITY POSITIONS

Various organizations have espoused the importance of security culture, often articulating it in the context of safety culture.

2.1 International Atomic Energy Agency (IAEA)

(taken from the IAEA website, under Safety and Security topic)

> **Safety and Security Culture**
> Establishing a strong safety and security culture is one of the fundamental management principles for an organization dealing with radioactive material. Such a culture influences the organization's structure and style, as well as the attitudes, approaches and commitment of individuals at all levels in the organization.
> All activities involving the use of radioactive material require careful attention to safety and security. Safety is aimed at preventing accidents; security is aimed at preventing intentional acts that might harm the facility or result in the theft of nuclear materials.
> Although these activities have a different focus, they overlap each other. Actions that are taken to further one activity can have implications for the others. Concerns about a radioactive release have long provided the justification for an emphasis on safety. In the aftermath of the 9/11 terror attacks and subsequent terrorist activities around the globe, operators, regulators and international organizations have all given increased attention to ensuring adequate security at facilities using radioactive material.
> In-depth analyses of a number of radiation and nuclear accidents have shown that weaknesses in either (or both) safety and security culture were one of the foremost root causes of the accidents.
> To understand the concepts of safety and security culture one must have insight into the overall notion of 'culture.' Culture is to society what memory is to individuals. Culture includes traditions that reflect "what has worked in the past." It also encompasses the way people have learned to look at their environment and themselves, and their unstated assumptions about the way the world is and the way people should act. (IAEA, Safety and Security Culture, 2017)

The idea of culture at the IAEA, according to their website, now incorporates both safety and security. This is consistent with the approach CNSC staff has taken with REGDOC-2.1.2

2.2 World Institute of Nuclear Security and the World Association of Nuclear Operators (WINS/WANO)

WINS is exploring integrating safety and security. From their website, an objective of one of their workshops was "To explore options to engage effectively with all internal and external stakeholders and move towards an organisation culture integrating security, safety and operational aspects." (WINS, World Institute for Nuclear Security, 2017)

Additionally, WINS and WANO have collaborated to find synergies between safety and security. From the WINS website:

> We are currently collaborating with the World Association of Nuclear Operators (WANO) to learn more about their approach to peer review in nuclear safety and operations. Our goal is to identify best practices that could be applied to corporate review of security management, assess security culture, and help organisations identify areas where management attention is needed. We will publish a report on this subject in late 2017. (WINS, World Institute for Nuclear Security, 2017)

And from the WANO website:

> WANO, the World Association of Nuclear Operators, and WINS, the World Institute for Nuclear Security, are pleased to announce a collaborative effort to examine the interface between nuclear safety and nuclear security. (WANO, 2012)

The approaches to understand the interface between safety and security between WINS and WANO demonstrates a desire in the nuclear industry to integrate these two areas. As such, the approach in the REGDOC integrating safety and security culture is aligned with this industry initiative.

2.3 Global Nuclear Safety and Security Network (GNSSN)

Information sharing between safety and security is of prime importance to the GSSN. From their website,

> The Global Nuclear Safety and Security Network (GNSSN) is one of the elements of the Global Nuclear Safety and Security Framework (GNSSF), related to the sharing of information and knowledge among the global expert community. This includes active or latent interactions between them that can support work related to nuclear safety and security matters. The Vision and Mission of GNSSN was set up with the aim of ensuring that critical knowledge, experience, and lessons learned about nuclear safety and security are exchanged as broadly as they need to be. (IAEA, Global Nuclear Safety and Nuclear Security Network, 2017)

This initiative has as its core mission to ensure safety and security are seen together, ensuring that lessons from one field informs the other. The idea of treating both safety and security together as opposed to in separate silos is realized in REGDOC-2.1.2.

2.4 International Meetings

There have been many international meetings that have addressed safety and security culture in harmony.

- March 11-13 2014, “Workshop on Safety Culture and Security Culture in the Pre-operational Phases” held in the United Arab Emirates (IAEA, 2014)
- August 25-26 2016, “Brazil-U.S. Workshop on Strengthening the Culture of Nuclear Safety and Security” held in Brazil (Rusek & Lowenthal, 2015)

- September 5-12 2015, “High Level Meeting to draft the Concept Paper in the Global Partnership on Nuclear Safety and Meeting to revise the Nuclear Safety and Security Framework” (Awad, 2015)
- June 20-23 2016, “9th Meeting of the Nuclear Security Guidance Committee (NSGC)”, whose agenda included “to identify conditions that would need to be met before a joint Safety–Security Fundamentals publication might be drafted” (Beaudette, 2016, p. 2)
- August 30-31 2017, “Technical Meeting to assess the overall structure, effectiveness and efficiency of peer review and advisory services in the areas of nuclear safety and security” (Webster, 2017)
- October 2-6 2017, “Managing the Interface between Safety and Security of Research Reactors” whereby the CNSC staff participant noted “All participating members had a level of integration between safety and security at their research reactors, either at the operational level or at the regulatory level.” (Ouelette, 2017, p. 2)

As can be seen, the interest in viewing safety and security together in an integrated fashion is raised at many international meetings. This integration is what the REGDOC is striving for.

All in all, there is international direction to treat safety and security together, from the IAEA, to bodies interested in a harmonized approach, through to technical meetings that discuss this subject. The REGDOC is aligned with this overall direction.

3. ANALYSIS OF SAFETY AND SECURITY INTEGRATION

This section looks more at the literature and the reasons therein to treat safety and security culture together.

3.1 Maturity differences and why to proceed

The seminal event for safety culture is widely acknowledged to be the event in Chernobyl in 1986, whereas the seminal event for security culture is often cited as the attack on September 11 2001 (Pettersen & Bjørnskau, 2015; Reniers, Cremer, & Buytaert, 2011). The developments in safety and security are, as a result, at different levels of maturity. As stated in INSAG 24,

> Nuclear power plants benefit from a sophisticated and comprehensive safety regime that has been established over the years. Although security issues are now receiving increased attention, the security regime for nuclear power plants is far less developed than the safety regime…as the security framework matures, safety and security obligations serve to reinforce each other. (IAEA, INSAG 24 - The Interface Between Safety and Security at Nuclear Power Plants, 2010, p. Forward)

This can also be seen in the peer reviewed literature. “Nuclear safety, nuclear security … regimes have not historically developed at the same pace and surely have not reached the same level of maturity” (Cipollaro & Lomonaco, 2016, p. 31). The Convention on Nuclear Safety report for the UK admits as much, “While there is a well-established safety culture at EDF NGL sites, an important challenge has been to extend training and awareness to ensure its security culture, including cyber security, becomes equally embedded” (Office of Nuclear Regulation, 2016, p. 27).

The differing levels of maturity acknowledged, there are reasons to integrate safety and security. At a societal level, the two are nearly indistinguishable, as populations would like to simultaneously be both safe and secure. Norway is addressing safety and security together as multi-dimensional interrelated concepts at a societal level (Høyland, 2017; Nilsen & et al., 2017). The public is indifferent concerning the source of the problem, be it safety or security. “When thinking about the perception of the nuclear risk in the public opinion, it does not make much difference if the launch of an emergency evacuation would be consequent to an eventual release produced by a safety-related accident or a security-related malicious act.” (Cipollaro & Lomonaco, 2016, p. 33)

The results of the Fukushima accident, classified as a safety event, could also have been seen if it had been a security event.

> The Fukushima accident revealed the critical vulnerabilities in nuclear safety. A Fukushima-like nuclear accident need not be caused by natural disaster; it could very well be caused by terrorist attack on, for example, a nuclear power plant’s emergency cooling system [Kim and Kang, 2012]. The safety vulnerabilities identified post Fukushima which included inconsistent or inefficient procedures, lack of personnel training, lack of communication between authorities, lack of coherent strategy, gaps in the legal framework and inadequate equipment are applicable to nuclear security as well [Biro, 2009]. (Gandhi & Kang, 2013, p. 357)

With this understanding, it is worth looking at some of the commonalities of safety and security.

3.2 Objectives, risk and tools

The overall objective for both safety and security is the same – to protect from undue harm. They also both deal with risk, however, the risk that they deal with is different.

> The main difference between safety and security (as we define them) is the origin of risk: safety considers hazards (i.e., how the system may harm the environment due to system failure or some combination of accidental conditions), while security considers threats and focuses on how potential attacks may impact the system's assets and its operation due to vulnerability. (Krias, Pietre-Cambacedes, Bouissou, & Halgand, 2015, p. 159)

This difference in origin, however, does not mean that there are not similarities in how the risk is dealt with. As seen from the viewpoint of industrial control systems

> both safety and security deal with risks, result in constraints, involve protective measures, and create requirements. These similarities indicate that some of the techniques applicable to one field could also be applicable to the other. Either accidents or attacks may eventually cause harm to the system assets (in terms of people, property, environments or services). (Krias, Pietre-Cambacedes, Bouissou, & Halgand, 2015, p. 158)

In fact, there have been analyses of tools that can be leveraged from safety to security, and from security to safety (Aven, 2007). In their paper Cross Fertilization between Safety and Security Engineering, the authors present a table of tools spanning from Architecture, graphical modeling, structured risk assessment and testing, and argue that many of the tools in one domain are being used in another. For example, defense in depth has been adopted as security in depth, faults trees have been adopted as threat and attack trees, failure sequence diagrams have been adopted for misuse sequence diagrams, and the list goes on (Pietre-Cambacedes & Bouissou, 2013, p. 122). They also state that “the potential for reciprocal inspiration between safety and security is still substantial” (Pietre-Cambacedes & Bouissou, 2013, p. 111). There are also initiatives to identify risk in the global supply chain that treat safety and security together (Speier, Whipple, Closs, & Voss, 2011), as well as industrial infrastructure (Krias, Pietre-Cambacedes, Bouissou, & Halgand, 2015). Even in the nuclear domain, “There are more similarities than differences in the nexus of nuclear safety and nuclear security” (Gandhi & Kang, 2013, p. 360).

Overall, with a common objective and even tools that can serve both domains, the integration of safety and security is being realized.

3.3 Similarities in safety and security culture

“The commonality between elements of nuclear security culture and nuclear safety culture has been widely discussed and acknowledged at the conceptual level for over a decade.” (Kuykendall & Khripunov, 2015, p. 34)

CNSC staff have done analyses of safety and security culture. Table 1 demonstrates that at the highest level, the characteristics or principles can be aligned.

Table 1 - Characteristics and Principles of Security and Safety Culture from WINS and the IAEA

WINS Security Culture "Characteristics"*	**IAEA Security Culture "Principles"+**	**IAEA Safety Culture "Characteristics"O**
Leadership and Motivation	Leadership	Leadership for Safety is Clear
Accountability	Motivation	Accountability for Safety is Clear
Integration	Commitment and responsibility	Safety is Integrated into all Activities
Professionalism and Competency	Professionalism and Competence	Safety is a Clearly Recognized Value
Learning and Improvement	Learning and Improvement	Safety is Learning Driven

* (WINS, International Best Practice Guide 1.4 Nuclear Security Culture, 2016, p. 7)
+ (IAEA, Nuclear Security Series No. 7 Nuclear Security Culture, 2008, p. 20)
O (IAEA, GS-G-3.5 The Management System for Nuclear Installations, 2009, p. 8)

The cultural level similarities have also been recognized in the literature. "…both share significant similarities: in both cases, the explicit commitment of senior management, a proactive training policy and understanding of all participants of the stakes and the role they play in terms of safety and security are essential components… The human factor plays a critical role in both safety and security" (Pietre-Cambacedes & Bouissou, 2013, p. 115). CNSC staff further analyzed elements (or indicators) associated with the characteristics, and the majority had no appreciable difference between safety and security. Some examples for which there is no significant change – the IAEA Safety Culture element description includes inherent elements of Security are shown in Table 2.

Table 2 - Comparison of elements common to safety and security culture

Element	**Safety**	**Security**	**Similarities**
Policy Statement	An organization pursuing activities with a bearing on nuclear plant safety makes its responsibilities well known and	Each organization needs to have a nuclear security policy which contains the aspects of a sound management system, as	A policy statement remains an important component in both safety and security culture guides. Both guides note

	understood in a safety policy statement. This statement is provided as guidance to staff, and to declare the organization's objectives and the public commitment of corporate management to nuclear plant safety. *–IAEA Safety Series No.75-INSAG-4* Development of a mission statement and program implementation guidance for Nuclear Safety Culture. – *CBRN Security Culture Discussion at the Global Partnership*	described in Section 4.3. This policy should declare a commitment to quality of performance in all nuclear security activities, making it clear that security has high priority, even overriding operational demands. If there is a conflict regarding the relative priorities of safety, security or operations, senior management must be authorized to resolve the conflict taking into account the overall impact of risk. *– IAEA Nuclear Security Series No.7* Development of a mission statement and program implementation guidance for Nuclear Security Culture. – *CBRN Security Culture Discussion at the Global Partnership*	that this policy statement should note the organizations objectives and commitment of corporate management to plant safety
Regular Review of Safety/ **Security Practices**	As a matter of policy, all organizations arrange for regular review of those of their practices that contribute to nuclear plant safety. *–IAEA Safety Series No.75-INSAG-4*	All of the concerned organizations must make arrangements for the regular review of their nuclear security practices and systems. This regular review necessarily takes into account lessons learned from both internal and external reviews, and changes in the threat level. In particular, organizations should ensure that all discrepancies detected relating to nuclear security are comprehensively analysed and expeditiously corrected. –	Regular review of safety/security practices is a shared element within both cultures

		IAEA Nuclear Security Series No.7	
Rewards and Sanctions	Ultimately, satisfactory practice depends on the behaviour of individuals, as influenced by motivation and attitudes, both personal and group. Managers encourage and praise and seek to provide tangible reward for particularly commendable attitudes in safety matters. *–IAEA Safety Series No.75-INSAG-4*	Managers influence culture throughout their organization through their leadership and management practices. With sustained effort, and by employing the incentives and disincentives at their disposal, they must establish patterns of behaviour and even alter the physical environment. *– IAEA Nuclear Security Series No.7*	Rewards and sanctions are a shared element to be included in a safety and security culture.
Questioning Attitude	Before an individual begins any safety related task, his or her questioning attitude raises issues such as those listed in the following: *–IAEA Safety Series No.75-INSAG-4*	Therefore, the principal shared objective of security culture and safety culture is to limit the risk resulting from radioactive material and associated facilities. This objective is largely based on common principles, e.g. a questioning attitude, rigorous and prudent approaches, and effective communication and open, two way communication. *– IAEA Nuclear Security Series No.7*	A questioning attitude is a shared element between both safety and security culture
Training and Education	Training and education ensure that all staff are knowledgeable about errors that might be committed in their area of activity. Such training is founded on a basic understanding of the safety questions involved, includes consideration of	The organization must allocate sufficient financial, technical and human resources to implement the assigned security responsibilities. It must ensure that all security personnel have the necessary qualifications, with these	Both safety and security cultures require effectively qualified and trained personnel to carry out appropriate responsibilities.

	the possible consequences of such errors, and deals specifically with how they may be avoided, or corrected if committed. – *IAEA Safety Series No.75-INSAG-4* Training for Nuclear Safety Culture Programs. – *CBRN Security Culture Discussion at the Global Partnership*	qualifications maintained by an appropriate training and development programme. – *IAEA Nuclear Security Series No.7* Training for Nuclear Security Culture Programs. – *CBRN Security Culture Discussion at the Global Partnership*	

All in all, there are many similarities in the cultural elements for both safety and security.

3.4 Differences in safety and security culture

While there are many similarities, this does not mean that safety and security culture are identical. There are some important differences. CNSC staff have identified three key differences between safety and security culture. These are shown at a high level in Table 3.

Table 3 - Differences in safety and security culture

Safety Culture	***Security Culture***
Openness	Compartmentalisation
Transparency	Secrecy/Confidentiality
Information Sharing	Classified/Classification

(WINS, International Best Practice Guide 3.2 Human Reliability as a Factor in Nuclear Security Rev.1.1, 2012, p. 4)

There are three key differences between safety and security culture that are highlighted in the framework in REGDOC-2.1.2. One key difference is seen in the security culture understanding of a credible threat. The “insider job” is a key element of security, and this the idea of a credible threat is one difference between security culture and safety culture. A second difference is the credible threat extended to ensure that anyone employed is appropriately screened, to try to as best as practicable identify security threats upon hiring. The third is classification of information, so that security sensitive information is appropriately dealt with.

These differences are not insignificant, and as such it is very important to ensure that the approach to safety and security is properly integrated.

3.5 Integration of safety and security

Transport Canada integrates both safety and security in their documents on management systems. “A safety/security management system (SMS/SeMS) is a set of management practices for systematically addressing safety/security risk within a transportation company.” (Rubenstein, 2017, p. 1)

The integration of safety and security is crucial to ensure that differences between the two domains are well understood. A non-coordinated overall approach can lead to conflicting demands and an approach that threatens an efficient, effective workflow (Pettersen & Bjørnskau, 2015). Even looking from an engineering standpoint, integrating safety and security makes sense.

> Novak et al. noted drawbacks of separating safety and security when related features are developed and integrated without regard for their dependencies. This separation may increase costs, implementation time and complexity, and dramatically reduce performance. The authors asserted that safety and security issues ought to be considered not only during requirement specification, but also during design, operation, maintenance, and decommissioning (i.e., over the complete lifecycle). (Krias, Pietre-Cambacedes, Bouissou, & Halgand, 2015, p. 159)

It is important to realize that this is not advocating a unified approach, where safety and security are treated identically, but an integrated approach that highlights their differences.

> … they outlined the advantages of integrating safety and security by harmonizing techniques from each domain: “[By] applying techniques developed in each domain, conflicts could become more apparent; better understanding of the system and its environment and recognition of risks related to each domain, separation of properties would permit recognition of conflicts and trade-offs and allow judgment-based decisions to be made.” The authors inferred that safety; security and their associated risk analysis techniques are closely related and have sufficient similarity to make integration a reasonable and achievable goal. (Krias, Pietre-Cambacedes, Bouissou, & Halgand, 2015, p. 161)

This integrated approach has also been recognized in the nuclear domain, “Consideration should also be given to the fact that although some safety systems can enhance security, at times security systems have been seen to interfere with safety practices and vice versa. Hence, it is essential that an integrated approach towards nuclear safety and security be adopted” (Gandhi & Kang, 2013, p. 357). They go on to describe that “in order to maximize the synergy between the safety and synergy, firstly the contradictory requirements between the two have been identified” (Gandhi & Kang, 2013, p. 358).

They develop this further,

> This conflict should be managed by proper coordination of methods, approaches and operating practices. Security and safety measures should be designed and implemented in an integrated manner such that implementation of safety measures do not compromise security and vice

> versa. To improve the synergy between safety and security, awareness of the intersection between nuclear safety and security should be increased. High level meetings on safety–security protocols should be convened regularly to ensure that the interface receives adequate attention. Operators should attempt to integrate the safety-security interface into the core operations of nuclear facilities. Safety and security measures must be built into a plant in all its phases, from design and construction, through operation, to decommissioning and dismantlement. (Gandhi & Kang, 2013, 360-361)

Hence, the integration of safety and security must not only recognize their differences, but understand the interfaces between the domains. The IAEA has written on this topic, specifically in TECDOC No. 1801, Management of the Interface between Nuclear Safety and Security for Research Reactors, and INSAG-24, The Interface Between Safety and Security at Nuclear Power Plants.

3.6 Integration of safety and security culture

This integration carries over into the cultural domain as well. The consortium of major Ph.D.–granting academic institutions, the ORAU, states the following on their website:

> There is a growing body of evidence indicating a strong, positive relationship between safety and security culture and performance outcomes. Several organizations and agencies concur on this relationship including: the United States Nuclear Regulatory Commission (NRC), the International Atomic Energy Agency (IAEA), the North Atlantic Treaty Organization (NATO), the National Academy of Sciences, the Institute for Nuclear Power Operations (INPO), the Office of Nuclear Reactor Regulations, and the Nuclear Energy Institute. (ORAU, 2017)

As stipulated in one of the IAEA documents mentioned, this integration needs to be done at the level of the management system.

> [T]he management system needs to clearly identify not only safety and security as distinct processes to be managed, but also the interface between them, so that the areas of common ground and, in particular, the areas of potential conflict between the two disciplines can be properly managed. (IAEA, TECDOC 1801 - Management of the Interface between Nuclear Safety and Security for Research Reactors, 2016, p. 15)

Information sharing is one of the more challenging differences between safety culture and security culture (Gandhi & Kang, 2013). This is all the more reason to have an integrated approach, as explained in the IAEA document

> Due to their nature, safety and security cultures take time and effort to develop to the degree that all personnel are unified in their perceptions and duties in relation to each culture. Both safety and security are the responsibility of everyone at the facility, although more emphasis on the one or the other may apply to specific actors. Safety and security cultures have to be actively promoted and coordinated by management in order to successfully interface safety and security at the facility and to enable

> affected personnel to know instinctively when to disseminate information to enhance safety and how to control sensitive information to maintain security. (IAEA, TECDOC 1801 - Management of the Interface between Nuclear Safety and Security for Research Reactors, 2016, p. 16)

An “innovative approach to measure and to enhance a company's safety culture and climate as well as its security culture and climate in one go” (Reniers, Cremer, & Buytaert, 2011, p. 1239) is detailed in the processing industry, with a strong emphasis on a model that includes a management systems construct. The importance of management is also very clear in the IAEA literature. “Management needs to promote both a safety and a security culture that serves to ensure that both objectives receive appropriate attention. Management emphasis on coordination is essential” (IAEA, INSAG 24 - The Interface Between Safety and Security at Nuclear Power Plants, 2010, p. 19).

4. PRACTICES OF SAFETY AND SECURITY INTEGRATION IN THE NUCLEAR SECTOR

4.1 Switzerland

The Swiss Nuclear regulator recognizes the integration of safety and security culture.

> Safety and security are aimed at the protection of man and the environment. ENSI considers that both a security perspective and a safety perspective must be firmly anchored in the culture of a nuclear installation, because at the end of the day both views are aimed at the same objective, namely the protection of humans and the environment against the harmful effects of ionising radiation.
> In the event of conflicts between safety and security requirements this must be recognised and constructive solutions must be found which fulfil all requirements. It is for these reasons that ENSI explicitly refrains from making a differentiation between safety culture and security culture. The safety culture includes both the aspects of nuclear safety as well as those of security and ENSI, in its supervision, treats them in an integrated manner. (ENSI, Security and safety as parts of the overall culture for the protection of man and the environment, 2017)

In their regulatory oversight report, ENSI explicitly stipulates that safety culture terminology is inclusive of security culture.

> For these reasons, ENSI explicitly refrains from drawing a distinction between safety and security culture in its supervisory activities, although it does consider the specific requirements for security and nuclear safety. The themes of safety and security are dealt with under the generic term safety culture and the associated supervisory activities are conducted in accordance with the methods and approaches described in this report. (ENSI, Oversight of Safety Culture in Nuclear Installations: ENSI Report on Oversight Practice ENSI-AN-8980, 2016, p. 8)

4.2 United States

> The US Nuclear Regulatory Commission has a nuclear safety culture policy statement, which encourages integrating security. From their website,
> As stated in the Safety Culture Policy Statement, organizations should ensure that personnel in the safety and security sectors have an appreciation for the importance of each, emphasizing the need for integration and balance to achieve both safety and security in their activities. Safety and security activities are closely intertwined. While many safety and security activities complement each other, there may be instances in which safety and security interests create competing goals. It is important that consideration of these activities be integrated so as not to diminish or adversely affect either; thus, mechanisms should be established to identify and resolve these differences. A safety culture that

> accomplishes this would include all nuclear safety and security issues associated with NRC regulated activities. (NRC, 2017)

4.3 Canada

4.3.1 CSA N286-12 Management System Requirements for Nuclear Facilities

This document is now the reigning standard for all Canadian Class1 nuclear licensees regarding their management system, although not yet fully implemented. The preface to this document explains the integrated approach of this standard.

> While this edition of CSA N286 was being planned, it was recognized that many of the same management system requirements apply not only to each life cycle phase of a nuclear facility but also to all aspects of the management of the facility, including health, safety, environment, security, economics, and quality. It was also recognized that lifecycle phase activities may be delegated to suppliers and, therefore, the requirements of this Standard apply to these activities. In addition, a graded approach, commensurate with risk may be defined and used when applying the requirements of this Standard.
> Before this Standard was drafted, two preparatory activities were undertaken that included an industry scan of applicable reference documents and a condition assessment to determine the impact and value of a management system that integrates the requirements from management system standards for health, safety, environment, security, economics, and quality. The conclusion of the industry scan was the trend in standards to move towards a more holistic approach of management, with the focus on providing direction to top management for creating purpose and commitment, capability, process definition and control, performance monitoring, and continual improvement. The conclusion of the condition assessment was that most nuclear facilities were being required to carry programs to comply with as many as ten different management, management system, or quality assurance standards. Most of these standards were directed at the same purpose, but requirements were not harmonized. This led to the conclusion that a single standard would be more effective with the purpose of establishing a management system standard that integrates the requirements from management system standards for health, safety, environment, security, economics, and quality. This edition both permits and recommends that organizations develop a single management system that integrates all management system requirements for health, safety, environment, security, economics, and quality (including Quality Assurance). (CSA, 2012, p. Preface)

The integration of all aspects of the lifecycle is clear – that safety and security culture are to be integrated is entirely consistent with the approach being taken currently by the nuclear industry. The emphasis on top management for this holistic approach is also clear.

4.3.2 Safety and security cultural assessments

While this not yet common in the nuclear industry, in 2016 Bruce Power undertook a safety and security cultural assessment. There are lessons to be learned to be sure, but these integrated assessments are possible.

Conclusion

This appendix set out to answer the question “Should REGDOC-2.1.2 Safety Culture include security culture?” Through presenting policy type evidence of Canada’s Obligations and Positions and International Community Positions, as well as research evidence from the scientific literature outlining both the analysis of safety and security integration and brief treatment of the practices of this integration, the answer to the posed question is that REGDOC-2.1.2 Safety culture should include security culture.

Works Cited

Aven, T. (2007). A unified framework for risk and vulnerability analysis covering both safety and security. Reliability Engineering and System Safety, 745-754.

Awad, R. (2015). Trip Report "High Level Meeting to draft the Concept Paper in the Global Partnership on Nuclear Safety and Meeting to revise the Nuclear Safety and Security Framework". Vienna: Canadian Nuclear Safety Commission e-Doc 5125209.

Beaudette, M. (2016). Trip Report: 9th Meeting of the Nuclear Security Guidance Committee. Vienna: Canadian Nuclear Safety Commission e-Doc 5118282.

Cameron, J. (2017, June 5). The Canadian Approach to Effective Safety and Security Interfacing. Nov 9, 2017, from Canadian Nuclear Society Annual Conference: http://www.nuclearsafety.gc.ca/eng/resources/presentations/2017.cfm

Cipollaro, A., & Lomonaco, G. (2016). Contributing to the nuclear 3S's via a methodology aiming at enhancing the synergies between nuclear security and safety. Progress in Nuclear Energy, 31-39.

CSA. (2012). N286-12, Management System Requirements for Nuclear Facilities. Mississauga: Canadian Standards Association.

Demeter, S. (2016). Helping Health Care Providers and Clinical Scientists Understand Apparently Irrational Policy Decisions. Cureus, 8(12):e936.

Directorate of Security and Safeguards, N. S. (2016). 2015 IPPAS Mission Management Action Plan. Ottawa: Canadian Nuclear Safety Commission e-Doc 5117248.

Directorate of Security and Safeguards, N. S. (2016). International Physical Protection Advisory Service (IPPAS) to Canada 2015 Post Mission Management Action Plan (MAP), Annex A. Ottawa: Canadian Nuclear Safety Commission e-Doc 5061890.

ENSI. (2016). Oversight of Safety Culture in Nuclear Installations: ENSI Report on Oversight Practice ENSI-AN-8980. Switzerland: ENSI.

ENSI. (2017). Security and safety as parts of the overall culture for the protection of man and the environment. Swiss Federal Nuclear Safety Inspectorate: https://www.ensi.ch/en/2017/03/13/security-and-safety-as-parts-of-the-overall-culture-for-the-protection-of-man-and-the-environment/

Galea, S. (2013). Values, Compelling Ideas, the Pace of Change and the Implementation of Evidence-Based Policy. Addiction, 846-851.

Gandhi, S., & Kang, J. (2013). Nuclear safety and nuclear security synergy. Annals of Nuclear Energy, 357-361.

Høyland, S. (2017). Exploring and modeling the societal safety and societal security concepts – A systematic review, empirical study and key implications. Nov 6, 2017, from http://dx.doi.org/10.1016/j.ssci.2017.10.019

IAEA. (2008). Nuclear Security Series No. 7 Nuclear Security Culture. Nov 8, 2017, from www-pub.iaea.org/MTCD/publications/PDF/Pub1347_web.pdf

IAEA. (2009). GS-G-3.5 The Management System for Nuclear Installations. Dec 4, 2017, from www-pub.iaea.org/MTCD/publications/PDF/Pub1392_web.pdf

IAEA. (2010). INSAG 24 - The Interface Between Safety and Security at Nuclear Power Plants. Nov 8, 2017, from www-pub.iaea.org/MTCD/publications/PDF/Pub1472_web.pdf

IAEA. (2014). *IAEA Global Nuclear Safety and Security Network*. Retrieved Jan 25, 2018, from Past IAEA NSNI Meetings and Workshops on the Topics of Management, Leadership and Culture for Safety; HOF: https://gnssn.iaea.org/NSNI/SC/SitePages/Home.aspx

IAEA. (2016, May 9). Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM/A). Nov 8, 2017, from https://www.iaea.org/publications/documents/conventions/convention-physical-protection-nuclear-material

IAEA. (2016, April 7). Convention on Nuclear Safety - 7th review meeting. Nov 8, 2017, from https://www-ns.iaea.org/conventions/nuclear-safety.asp?s=6&l=41

IAEA. (2016). TECDOC 1801 - Management of the Interface between Nuclear Safety and Security for Research Reactors. Nov 8, 2017, from http://www-pub.iaea.org/books/IAEABooks/11082/Management-of-the-Interface-between-Nuclear-Safety-and-Security-for-Research-Reactors

IAEA. (2017). Global Nuclear Safety and Nuclear Security Network. Nov 8, 2017, from http://www-ns.iaea.org/coordination/gnssn.asp

IAEA. (2017). Safety and Security Culture. Nov 08, 2017, from https://www.iaea.org/topics/safety-and-security-culture

Jennings, P. (2017, Nov 1). IAEA International Ministerial Conference on Nuclear Power. Nov 8, 2017, from https://www.iaea.org/sites/default/files/cn-247-canada-statement.pdf

Krias, S., Pietre-Cambacedes, L., Bouissou, M., & Halgand, Y. (2015). A survey of approaches combining safety and security for industrial control systems. Reliability Engineering and System Safety, 156-178.

Kuykendall, T., & Khripunov, I. (2015, Winter). Examining the Interface Between Nuclear Security Culture and Nuclear Safety Culture. Nov 8, 2017, from 1540 Compass: http://spia.uga.edu/departments-centers/center-for-international-trade-and-security-cits/1540compass/

Nilsen, M., & et al. (2017). Changes in Norway's societal safety and security measures following the 2011 Oslo terror attacks. Nov 06, 2017, from http://dx.doi.org/10.1016/j.ssci.2017.06.014

NRC. (2017). Safety Culture and Nuclear Security. U S Nuclear Regulatory Commission: https://www.nrc.gov/about-nrc/safety-culture/sc-nuclear-security.html

Office of Nuclear Regulation. (2016, August). The United Kingdom's Seventh National Report on Compliance with the Obligations of the Convention on Nuclear Safety. Convention on Nuclear Safety: https://www-

ns.iaea.org/downloads/ni/safety_convention/7th-review-meeting/uk_03052017_nr-7th-rm.pdf

ORAU. (2017). Security Culture. Centre for Safety Studies: https://www.orau.org/safetystudies/security-culture.aspx

Ouelette, L. (2017). Managing the Interface Between Safety and Security of Research Reactors. Vienna: Canadian Nuclear Safety Commission.

Pettersen, K. A., & Bjørnskau, T. (2015). Organizational contradictions between safety and security - Perceived challenges and ways of integrating critical infrastructure protection in civil aviation. Safety Science, 167-177.

Pietre-Cambacedes, L., & Bouissou, M. (2013). Cross-fertilization between safety and security engineering. Reliability Engineering and System Safety, 110-126.

Reniers, G. L., Cremer, K., & Buytaert, J. (2011). Continuously and simultaneously optimizing an organization's safety and security culture and climate: The Improvement Diamond for Excellence Achievement and Leadership in Safety and Security (IDEAL S and S) model. Journal of Cleaner Production, 1239-1249.

Rubenstein, M. (2017). Audit of the Oversight Practices of Safety and Security Management System. Ottawa: Transport Canada.

Rusek, B., & Lowenthal, M. (2015). Brazil-U.S. Workshop on Strengthening the Culture of Nuclear Safety and Security: Summary of a Workshop. Washington: The National Academies Press.

Schriefer, D. (2012). 3 – Safeguards, security, safety and the nuclear fuel cycle. In I. Crossland, Nuclear Fuel Cycle Science and Engineering (52-79). Woodhead Publishing.

Speier, C., Whipple, J. M., Closs, D. J., & Voss, D. M. (2011). Global supply chain design considerations: Mitigating product safety and security risks. Journal of Operations Management, 721-736.

Sullivan, J. (2016). Building a Corporate Culture of Security -Strategies For Strengthening Organizational Resiliency. Amsterdam: American Board of Forensic Engineering & Technology American College of Forensic Examiners Institute; Butterworth-Heinemann.

WANO. (2012). World Association of Nuclear Operators. Building a Stronger Connection between Nuclear Safety and Nuclear Security: http://www.wano.info/en-gb/mediaandevents/pressreleasesandannouncements/Pages/Building-a-Stronger-Connection-between-Nuclear-Safety-and-Nuclear-Security.aspx

Webster, P. (2017). Trip Report "Technical Meeting to assess the overall structure, effectiveness and efficiency of peer review and advisory services in the areas of nuclear safety and security". Vienna: Canadian Nuclear Safety Commission e-Doc 5345154.

WINS. (2012). International Best Practice Guide 3.2 Human Reliability as a Factor in Nuclear Security Rev.1.1. Vienna: WINS e-Doc 5267986.

WINS. (2016). International Best Practice Guide 1.4 Nuclear Security Culture. Vienna: World Institute for Nuclear Security.

WINS. (2017). World Institute for Nuclear Security. https://wins.org/

Yoo, H., & Lee, J. (2015). Results of nuclear security culture survey on personnel at nuclear power plants. Annals of Nuclear Energy, 398-402.

APPENDIX B. SYNOPSIS FROM SCIENCE & BENCHMARKING SUPPORTING REGDOC-2.1.2, *SAFETY CULTURE*

Contents

Introduction to the review

Purpose

This technical rationale document supports the requirements of REGDOC-2.1.2 Safety Culture. Specifically, it highlights the "why, how and what" of safety culture and safety culture assessments. The question it seeks to answer is "Is the approach taken in REGDOC-2.1.2 reasonable?" by asking the related question "Is the approach scientifically sound and consistent with the literature"?

Methods for this review

The materials informing this literature search for this review were found through searching "safety culture" in Proquest, Scholar's Portal, Science Direct, Scopus, SpringerLink and the National Academy of Sciences. Information used in this review was restricted to the last 10 years, 2007 – 2017, aside from seminal literature. Regulations were word searched for "safety culture", and specific regulations were downloaded from the Canada Gazette Part II website. Nuclear industry country specific information came from Convention on Nuclear Safety reports, as well as personal communications through the NEA Work Group on Human and Organizational Factors (see WGHOF Communication for more detail). After reviewing seminal literature, the material was keyword searched through the Adobe multiple.pdf document search function.

Document structure

The document walks through the sections of the REGDOC in an organized fashion. The sections of this review are:

1. Importance of safety culture
2. CNSC background with safety culture
3. Expectations regarding safety culture
4. Requirement 1 – Fostering Safety Culture through a Formal Commitment
5. Requirement 1 – Fostering Safety Culture through Continual Monitoring
6. Requirement 2 – Safety Culture Assessment – General
7. Requirement 2 - Safety Culture Assessment – Methods
8. Requirement 2 - Safety Culture Assessment – Framework
9. Appendix - Maturity Model

With a few exceptions, each section is structured in the following way:

REGDOC-2.1.2 contents (for all sections that have a requirement or an appendix)
CSA Standard (if applicable)
IAEA Documents
SRS 83
Literature
Nuclear industry benchmarking
Other industry benchmarking
Summary

It is worth noting that while SRS 83 “Performing Safety Culture Self-Assessments” is an IAEA Document, it is given more weight in this analysis due to its relevance to the subject matter of this REGDOC. Other IAEA Documents are quoted when they have material relevant to the subject. All evidence (REGDOC, IAEA, or literature) directly quoted is either in the text or in an offset justified paragraph.

The benchmarking in this review takes advantage of when traceable information is available for a country (in the case of nuclear benchmarking) or an industry (in the case of other than nuclear benchmarking), but does not have a strict adherence to every country (or industry) having an entry in each section. In other words, if nothing was found in the information sources on a country’s or industry’s position on a specific topic, that country or industry does not appear in that section.

Acronyms

AECB – Atomic Energy Control Board
BARS – Behavioral Anchored Ranking Scales
BC - British Columbia
CAMM – Canadian Adaptive Machine Model
CANSO - Civil Air Navigation Services Organization
CNS – Convention on Nuclear Safety
CNSC – Canadian Nuclear Safety Commission
CSA – Canadian Standards Association
CSN – Spanish Nuclear Safety Council
DIS – Discussion Paper
ENSI – Eidgenossenschaft Scweizerische (Swiss Federal Nuclear Safety Inspectorate)
GS – Safety Guide
GSR – General Safety Requirements
HSS – Office of Health, Safety and Security
IAEA – International Atomic Energy Agency
INSAG – International Nuclear Safety Advisory Group
NAS – National Academy of Sciences
NCSA – Nuclear Safety and Control Act
NEA - Nuclear Energy Agency (International)
NEI – Nuclear Energy Institute (American)
NPP – Nuclear Power Plant
NSCMP – Nuclear Safety Culture Monitoring Panel
REGDOC – Regulatory Document
RSP – Research and Support Program
SCSA – Safety Culture Self Assessment
SCWE – Safety Conscious Work Environment
SMS – Safety Management System
SRS – Safety Report Series
STUK - Säteilyturvakeskus (Finland Radiation and Nuclear Safety Authority)
UK – United Kingdom
US NRC – United States Nuclear Regulatory Commission
WGHOF – Work Group on Human and Organizational Factors

1. Importance of Safety Culture

This section deals with "why" safety culture is important.

1.1 REGDOC contents

(Guidance)
1. Introduction
This section provides information for all licensees.
A healthy safety culture is a key factor in reducing the likelihood of safety-related events and mitigating their potential impact, and in continually improving safety performance. All workers, from senior managers downwards, have a shared responsibility to ensure that a healthy safety culture is a priority.
The approach taken in this regulatory document is based upon the following principles:
Principle 1 Every organization has a safety culture.
Principle 2 Safety culture is influenced by external and internal factors including all workers.
Principle 3 Safety culture is complex and changes over time.
Principle 4 Safety culture needs to be assessed and monitored to achieve the common goal of understanding the organization's safety culture and limiting risk.
Principle 5 Safety culture assessment and improvement activities are informed by a defined framework of key characteristics known to reflect a healthy culture.
A healthy safety culture is an interpretation of how safety is integrated into everyday work and interactions, rather than a program to be managed. It is reinforced in how people, including leadership, work together to create a deeper understanding of the culture and its impacts on safety. (CNSC, 2017, p. 1)

1.2 IAEA Documentation

The recent document on Leadership and Management for Safety, GSR part 2, underlines the importance of safety culture for leadership.

5.2. Senior managers and all other managers shall advocate and support the following:
(a) A common understanding of safety and of safety culture, including: awareness of radiation risks and hazards relating to work and to the working environment; an understanding of the significance of radiation risks and hazards for safety; and a collective commitment to safety by teams and individuals;
…
(f) The means by which the organization seeks to enhance safety and to foster and sustain a strong safety culture, and using a systemic approach (i.e. an approach relating to the system as a whole in which the interactions between technical, human and organizational factors are duly considered); (IAEA GSR Pt 2, 2016, 15, 16)

1.2.1 SRS 83

The main document on assessing safety culture, SRS 83, has far more information on safety culture – its importance, conceptions of it, misunderstandings surrounding it, and pitfalls in measuring and reporting it.

The first area SRS addresses is the conception of culture. As described, the IAEA ascribes to the Dr. Edgar Schein model of visible artefacts, an articulable layer of values, and a deeper layer of basic assumptions. This is described below:

> The greatest risk in trying to understand culture is to oversimplify it. It is tempting to believe that culture is merely 'the way we do things around here' or to reduce it to corporate slogans. Organizational culture is a broad term that encompasses all the different cultural facets of an organization, including safety culture. A well-grounded image of an organization's culture needs to take into consideration the various visible manifestations — appearing above the surface — such as behaviour, verbal expressions and physical objects. However, any statement about the character of the culture also needs to reach below the surface. The accumulation and thematizing of (visible) attributes of the culture are the initial steps in a cultural analysis, but are not in themselves sufficient. The iceberg model means that the visible aspects may also be explained, for example, in terms of formal and informal control systems, and leadership.... Culture is a matter of seeing things from different perspectives or looking at alternative ways of explaining why things happen. (IAEA SRS 83, 2016, 5-6)

Given the visibility of artefacts that are supported by a large base of values and basic assumptions that are not necessarily visible, the analogy of an iceberg is often used to describe this model of safety culture – with only a very small part of the iceberg being visible above the water, but a much larger mass that is also iceberg is located below the surface.

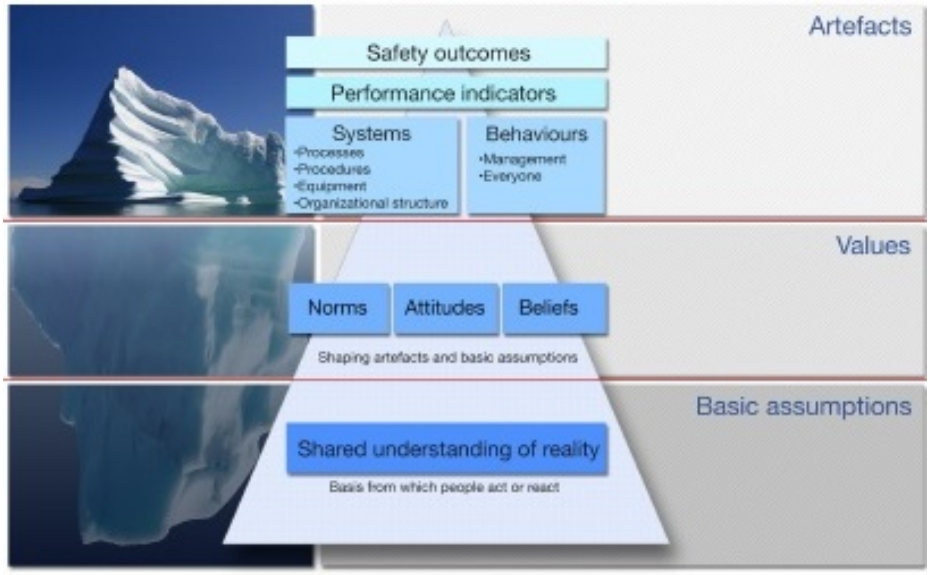


FIG. 1. The iceberg model of safety culture.

(IAEA SRS 83, 2016, p. 6)

Another aspect that SRS 83 covers is how safety culture assessments differ from the more familiar traditional audit.

> Strengths and blind spots within a particular culture can be identified by interpreting what people say, the behaviour of leaders and staff, and other visible aspects (e.g. safety performance data, policies, standards of housekeeping and material condition, how incidents are investigated and how findings are addressed). SCSAs differs from other types of self-assessment in that it requires a deeper understanding of the underlying organizational and cultural issues behind what is observed and reported. An SCSA will not generally lead to clear-cut and easily actionable results, but it will lead to an increased understanding of why different safety related issues appear, and it will provide insight into what may be done to enhance safety…. Gaining an understanding of underlying safety culture issues requires extensive involvement and participation from all levels of the organization. The assessment process focuses heavily on the perceptions, views and behaviour of people at all levels. This is in contrast to audit type assessments, where the focus tends to be on technical facts rather than perceptions and behaviour. (IAEA SRS 83, 2016, p. 7;8)

Some key ideas are expressed here – that a safety culture self-assessment is participatory, using perceptions, views and behaviour, and is often best seen as a self-reflection (an organizational mirror) that gains insight and understanding of how the organization sees safety in its everyday reality.

> Investigations into events in nuclear and other industries consistently highlight organizational and cultural root causes. Common themes have been identified as [8]:

- An insufficient understanding of 'operational reality' by leaders ('good news' culture and a failure to encourage constructive challenge);
- Inadequate oversight and supervision, including contractors;
- Insufficient understanding of nuclear and process safety issues in decision making and actions;
- Normalization (acceptance) of abnormal conditions or deviations;
- A failure to learn from previous events.

These and other culturally related issues are not easy to describe or address, and require long term, persistent work to produce effects. Culture is often an unplanned product of long term growth processes. It is impossible to control such processes totally, but through the careful application of SCSAs, it is possible to comprehend and influence culture. (IAEA SRS 83, 2016, p. 16; 17)

Here, we see that safety culture has routinely been seen in investigation reports, and that while cultural aspects are challenging to identify and articulate, and even harder to change, assessments of safety culture can allow a deeper understanding, as well with a "careful application" to influence culture.

1.3 Nuclear Industry Definition

During the consultation for this REGDOC, the author had showed the similarities of a few of the various definitions in use in the nuclear industry

INPO/WANO/US NRC

> Nuclear safety culture is defined as the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment.

IAEA

> The assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance.

CNSC

> The characteristics of the work environment, such as the values, rules, and common understandings that influence workers' perceptions and attitudes about the importance that the organization places on safety.

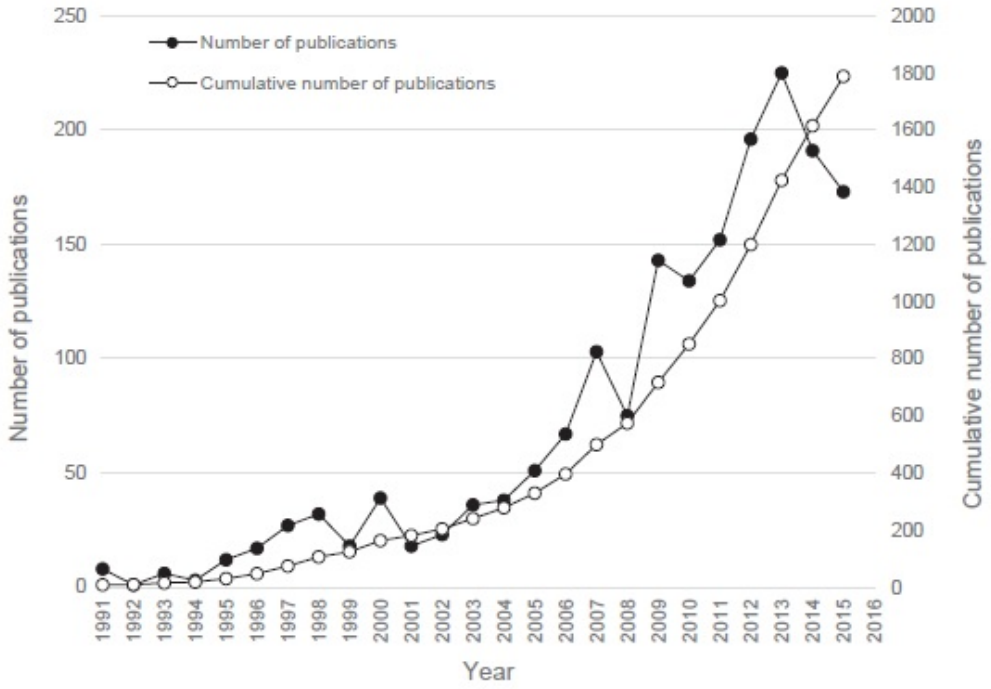
The underlined words highlight the similarities of these definitions (values, collectivity, and importance of safety), and the goals of all three of these definitions are the same. Consistent with the Schein model, the IAEA and CNSC definitions do not draw attention to behaviours (artefacts), but emphasize values, and the overall importance of safety to the organization (suggestive of a basic assumption). Furthermore, the CNSC does not use the word "priority", which suggests metrics, positioning amongst other priorities, and overall leaning towards the artefact level of Schein's model.

1.4 Literature

When a field has an overwhelming amount of published literature, it is difficult to get a full appreciation of that field, let alone undertake a thorough systematic review or a "structured overview of relevant information. Bibliometric analysis is a technique which makes it possible to provide a macroscopic overview of large amounts of academic literature." (van Nunen, Li, Reniers, & Ponnet, 2017 (in press)). A bibliographic analysis has been recently published on safety culture. From the introduction,

The research topic of safety culture is a relative new one in terms of academic research. The concept was first used in 1986 in response to the Chernobyl disaster (EU-OSHA, 2011). From then on, an increased attention in the research area of safety culture can be observed. This increase is driven by the fact that, despite improvements over the years, disasters, accidents and incidents continue to persist in organisations, at home, and at all other levels of society. This has led to a continuously growing publication rate regarding safety culture, which makes it difficult to obtain a comprehensive overview on the topic. (van Nunen, Li, Reniers, & Ponnet, 2017 (in press))

Advantages of a bibliographic analysis include identifying the seminal literature, the journals specializing in the topic, the countries publishing in the area, main institutions, authorship, etc. The amount of literature has obviously increased over time, as seen below.



(van Nunen, Li, Reniers, & Ponnet, 2017 (in press))

> Looking at the cumulative number of publications in Fig. 2, it can be stated that the importance of safety culture research has increased. It took approximately twenty years (from 1991 until 2011 inclusive) to reach a total of 1000 publications on the topic of safety culture. The following four years (from 2012 until 2015 inclusive), this number increased to a

> total of almost 1800 publications. (van Nunen, Li, Reniers, & Ponnet, 2017 (in press))

The analysis consisted of 1789 publications on safety culture, with 31 776 unique references. A more illustrative diagram can be seen below, where both a terms analysis and a timescale are mapped onto a VosViewer map, whereby the size of the circles represent the frequency of the term, and the colour represents the time at which the terms appeared.

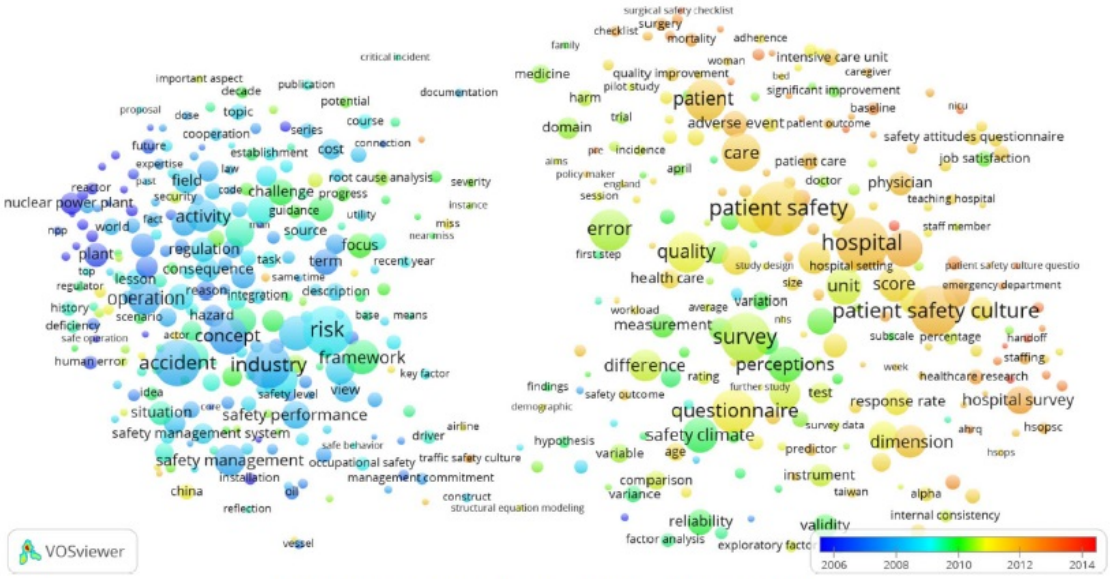


Fig. 11. Terms analysis of safety culture publications with time information.

(van Nunen, Li, Reniers, & Ponnet, 2017 (in press))

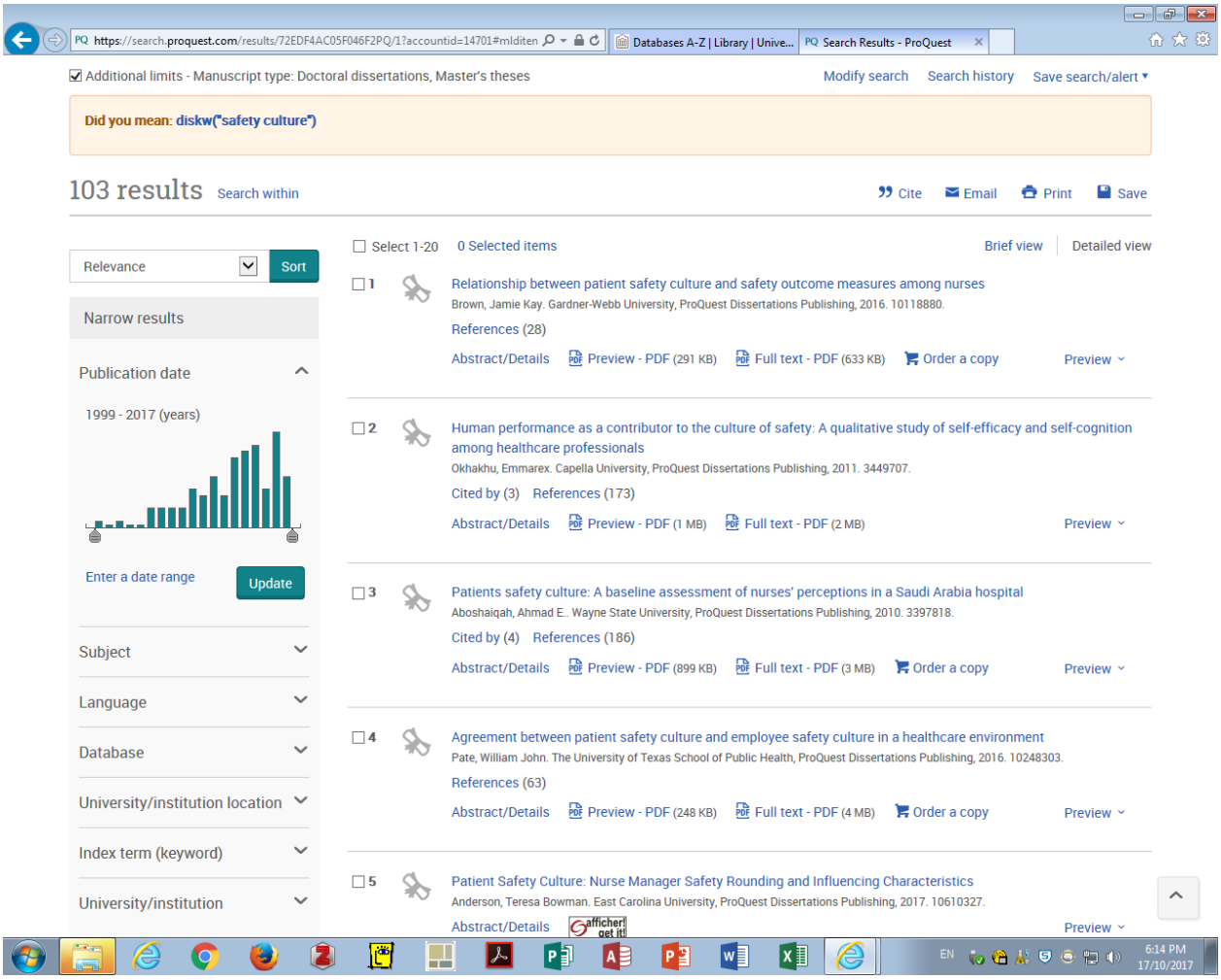
Their text sheds a bit more context on the diagram.

> Looking at the time periods, most research around 2006 was conducted in the content area of nuclear safety (corresponding terms such as nuclear power plant, reactor, nuclear technology). Most research around 2008 focussed on organisational safety, and more specific on the technical and organisational aspects (corresponding terms such as risk, accident, industry, technology, safety management, safety management system). Around 2010, a lot of safety culture research focussed on safety climate and perceptions. Finally, the map shows an increasing trend in publications related to health-care and patient safety, as the corresponding terms (patient safety, nurse, hospital, patient safety culture, care, etcetera) are mostly used in recent years.
>
> To summarise, the time map of terms shows a movement away from organisational safety culture in general, and a movement away from more technical factors in particular. Along with the development of safety culture, human aspects such as perceptions, safety climate, workload, and job satisfaction, were given greater importance than technology. …Publications on health-care and patient safety stand in a dominant position in safety culture research nowadays. It should be noted that this

> does not mean that lesser attention is being paid to organisational culture – a lot of research on this topic is still being performed, and needed – but that publications on health-care and patient safety culture gain the upper hand. (van Nunen, Li, Reniers, & Ponnet, 2017 (in press))

As such, while the origins of safety culture were in the nuclear industry, now healthcare has as many (or more) publications on safety culture.

In preparing this document, the author undertook a textual search of selected recent safety culture related graduate theses (to find the seminal literature, which the bibliographic analysis later confirmed); a screen shot of the ProQuest search is shown below.



This screenshot reveals that a) the number of theses that can be searched with keywords "safety culture" have risen since 1999, and that the first 5 theses displayed with such a search are all in the healthcare domain, confirming some results of the bibliographic analysis.

While the seminal document in safety culture is often quoted to be INSAG 4 (IAEA, 1991), the very first occurrence of the term "safety culture" was the "Summary Report on the Post Accident Review Meeting on the Chernobyl Accident", Safety Series 75,

INSAG 1, 1986 (Choudhry, Fang, & Mohamed, 2007, p. 996). Safety climate had been in the literature and well-studied by this point, with the main work on safety climate being Zohar (1980); safety climate is now seen as more focused on occupational health and safety, and often focused on Schein's artefacts, as opposed to the deeper levels that safety culture has as its core. The most referenced work as it related to safety culture is Guldenmund (2000). Through a thorough literature review, he found some principles that are core to safety culture.

1. It is a construct.
2. It is relatively stable.
3. It has multiple dimensionality.
4. It is something that is shared.
5. It consists of various aspects.
6. It constitutes practices.
7. It is functional (Guldenmund F. W., 2000, 222-225)

While at that time, research had been undertaken on safety culture, everything from a clear definition to a unified construct was elusive. The term "culture" originated in anthropology (NAS Transit Cooperative Research Program Report 174, 2015), where researchers studied peoples through ethnographic means (chiefly observation and interaction – at any rate, highly participatory).

> The fact is that the concept of safety culture has not developed theoretically from the organizational culture. INSAG-3 (1988) explains that 'the phrase safety culture refers to a very general matter, the personal dedication and accountability of all individuals engaged in any activity which has a bearing on the safety of nuclear power plants'. However, the meaning of the term was left open to interpretation, with guidance lacking on how 'safety culture' could be assessed. (Choudhry, Fang, & Mohamed, 2007, p. 996)

Safety culture now is studied by many different disciplines – anthropologists, sociologists, psychologists, and engineers - among others, which has resulted in a variety of approaches in describing and assessing safety culture (van Nunen, Li, Reniers, & Ponnet, 2017 (in press); Choudhry, Fang, & Mohamed, 2007, p. 996). Guldenmund, with ample reference to Schein, gives some detail to his model of artefacts, values and basic assumptions.

Levels of culture, their visibility and examples thereof

Levels of culture	Visibility	Examples
1. Outer layer — artefacts	Visible, but hard to comprehend in terms of underlying culture	Statements, meetings, inspection reports, dress codes, personal protective equipment, posters, bulletins
2. Middle layer — espoused values/attitudes regarding: -hardware, -software, -people/liveware, -risks	Relatively explicit and conscious	Attitudes, policies, training manuals, procedures, formal statements, bulletins, accident and incident reports, job descriptions, minutes of meetings
3. Core — basic assumptions regarding: -the nature of reality and truth, -the nature of time, -the nature of space, -the nature of human nature, -the nature of human activity, -the nature of human relationships	Mainly implicit: obvious for the members, invisible, pre-conscious	Have to be deduced from artefacts and espoused values as well as through observation

(Guldenmund F. W., 2000, p. 251)

> The appeal of this framework is that it fuses safety climate and safety culture and that it also does justice to the integrative, holistic concept of culture as advocated by, for instance, cultural anthropologists. In addition, another elaboration can be made. As has been claimed above, the basic assumptions do not have to be specifically concerned with safety. Although they do not have to be specifically so, it is quite conceivable that some of the organisation's basic assumptions in fact are, when safety is taken seriously within the organisation and reflected upon by all of its members. This would certainly lead to an anchoring of safety within the basic assumptions. This supposition could be converted into a hypothesis stating that it is a good sign that, among the basic assumptions of an organisation, references to safety are made. Conversely, it is suspect when such references cannot be found. It might very well be that one has to conclude that such an organisation does not yield sufficient evidence for the existence of a safety culture. (Guldenmund F. W., 2000, p. 252)

With the basic assumptions being influenced beyond only safety, there are studies now studying national culture (Cooper, 2000; Reader, Noort, Shorrock, & Kirwan, 2015; Tear, Reader, Shorrock, & Kirwan, 2016), leadership (IAEA GSR Pt 2, 2016; Westrum, 2004; Pilbeam, Doherty, Davidson, & Denyer, 2016; Martínez-Córcoles, Gracia, Tomás, & Peiró, 2011; Heese, 2012), and the overall complexity of cultural studies (Petitta, Probst, Barbaranelli, & Ghezzi, 2017; Shirali, Shekari, & Angali, 2016; Weaver, et al., 2013). The concept of safety culture is actually merging two different fields:

> The term *nuclear safety culture* combines two concepts: *safety* and *culture*:

- *Safety* is protection from harm and can be defined in terms of risk: an activity is considered to be safe when its associated risks are being controlled to acceptable levels.
- Culture comprises the collective beliefs, values, and behaviors of individuals belonging to an organization (e.g., a company). It includes behavioral norms, shared attitudes, shared traditions, and mechanisms for incentivizing and reinforcing desired behaviors. (National Research Council, 2014, Ch. 7)

There is also an appreciation of the nature of this area, as cultural studies have evolved beyond their origins.

> Culture then needs to be understood as systems of interconnected meanings, beliefs and values whose "site" is something neither easy to "fix" nor to link directly to particular individuals…Within the safety community, culture is increasingly being seen as a "prime mover" and as something that is relatively easy to both define and quantify. But social science has tended to move in the opposite direction (Wallerstein, 1996). In the social sciences, no longer is culture seen as the primary mechanism of social life. At most, it is one among many…Safety scientists have to acknowledge, like almost all social scientists, that no one term or mechanism, no matter how abstract or seductive, can adequately explain the social order in which we live. While this may seem obvious, it seems it has become all too easy to use the term "culture" to refer to any and all aspects of social life. (Myers, Nyce, & Dekker, 2014, 27, 28)

This view is echoed by Guldenmund

> Ever since the International Nuclear Safety Advisory Group (INSAG) coined the term "safety culture" to denote the far from optimal conditions and decision processes in place at the Chernobyl nuclear power plant,(1) it has gradually settled itself in the standard explanatory safety vocabulary. Safety culture has become a term used by people all around the globe to explain everything relating to safety failures that cannot be explained in another way. (Guldenmund F. W., (Mis)understanding Safety Culture and Its Relationship to Safety Management, 2010, p. 1466)

The point of studying safety culture, overall, is to prevent catastrophic accidents (Guldenmund F. W., 2000; Cooper, 2000; Shirali, Shekari, & Angali, 2016). While some studies have been challenged to find a link between safety culture and performance (Cole, Kerstan S.; Stevens-Adams, Susan M.; Weneer, Caren A.; Sandia Labs, 2013, p. 3), others claim that improved safety culture has yielded better performance (Morrow, Koves, & Barnes, 2014, p. 76; Warszawska & Kraslawski, 2016, p. 27). The diverse background to safety culture as well as its link to performance is expressed in the aviation field:

> Ambiguities in the definition of safety culture reflect its diverse empirical and theoretical origins. For example, anthropological perspectives emphasize the role of societal belief systems in determining safety culture, while normative perspectives emphasize organizational policies and group

> interactions.(8) The safety culture concept is seen as useful because a "strong" safety culture is where beliefs and activities in relation to safety are positive, leading to a reduced likelihood of organizational mishaps. Conversely, a "weak" safety culture can reflect poor safety practices, which increases accident probability. Empirical research examining the association between safety culture and safety performance supports this assertion,(4,9,10) and thus despite its somewhat ethereal nature, safety culture is often conceived as an organizational property that is attainable and measurable.(11) (Reader, Noort, Shorrock, & Kirwan, 2015, p. 771)

A review undertaken for the oil and gas industry in specific from 1980-2010 helps elucidate how common safety culture is implicated in major accidents.

> Six out of the 17 major accident reports make direct reference to safety culture (Piper Alpha, BP Texas City, Usumacinta, Montara, Sikorsky S-92A, and Deepwater Horizon). Excluding the Piper Alpha disaster, the five remaining disasters, in which the official inquiry report highlighted the importance of safety culture, occurred within the last six years. This is reflective of the recent understanding and acceptance of the importance of developing a positive safety culture as a preventive measure for organizational disasters. (Fleming & Scott, n.d., p. 20)

The authors then undertook their own safety culture analysis of the inquiry reports.

> This more detailed analysis increased the number of inquiries that identified safety culture as a causal factor to fourteen. Therefore, only three of the seventeen inquiry reports reviewed (Cormorant Alpha helicopter accident [1992], East Cameron Block, blowout [1997], and Leman Field helicopter accident [2002]) did not have any causal factors that could be classified into one of the four indicators of a poor safety culture. The majority of the reports (9) identified multiple cultural factors that contributed to the disaster. There is also variability in how frequently each of the four cultural factors were identified within the reports. The following is a list of the relatively frequency of each cultural factor.
>
> - Tolerance of inadequate systems and resources (identified 10 times)
> - Normalization of deviance, (identified 9 times)
> - Complacency, (identified 8 times)
> - Work pressure (identified 4 times)
>
> (Fleming & Scott, n.d., p. 23)

While oil and gas is only one industry, the safety culture analysis of accident inquiries would likely reveal similar findings in other industries as well (e.g. transportation, space exploration, nuclear power, military) (Shirali, Shekari, & Angali, 2016, p. 279). In addition, these other fields have helped advance the understanding and assessment of safety culture, "The results of the review revealed that the majority of attempts to define and assess safety culture have arisen outside the nuclear industry even though the term itself has been first introduced in the nuclear field" (Mkrtchyan & Turcanu, 2012, p. 48).

1.5 Summary

Safety culture has been well studied, by many different disciplines and many different fields. It pervades the organization from visible artefacts to subconscious basic assumptions. It has been implicated in many accident inquiries, and may have become an overused term. Its roots come from the social sciences, which inform its assessment. This is consistent with the approach taken in REGDOC-2.1.2.

2. CNSC background

As early as 1990, the Atomic Energy Control Board (AECB) was interested in safety culture, as evidenced by the Advisory Committee on Nuclear Safety's report 17 entitled "Improving the Safety Culture of Human Organizations: A Proposal for Institutional Quality Assurance". This Report referenced the (at the time) recent Chernobyl disaster, as well as Three Mile Island, The King's Cross underground disaster in London, the Exxon Valdez oil spill, and other unreferenced disasters which had safety culture – type organizational failings that led to the disasters. In 1998, the AECB commissioned a research report RSP-0060, "Development of a Regulatory Organizational and Management Review Method" (Haber & Barriere, 1998), colloquially known as the "O&M method". The purpose for the research is given below.

> The purpose of this project, conducted for the Atomic Energy Control Board of Canada (AECB), was to develop an assessment methodology that can be applied to organization and management in Canadian nuclear facilities. To achieve this objective, the development of an in-depth understanding and model of the human organizational characteristics that influence safety in a Canadian nuclear facility was undertaken. The model serves as a basis for creating reliable and defensible methods and standards that the AECB can use in their regulatory assessment of organization and management processes and structures. (Haber & Barriere, 1998, p. iii)

This method employed the Canadian Adaptive Machine Model. "CAMM depicts the structure and function of the human organization including key organizational and management functions and processes that relate to safety performance" (Phillps, 2008, p. 3). It used various methods to assess the constructs related to safety culture, namely functional analysis (provides a description of the organizational workflow), structured interview protocol (a standardized database of questions), behavioural checklists (readily observable key behaviors), Behavioral Anchored Rating Scales (BARS) (behavioral examples with general performance dimensions) and Survey Techniques (standardized questionnaire) (Haber & Barriere, 1998, p. 28). It also defined who should be evaluated, such as those who contribute to the Corporate Utility, the Strategic Apex, the Middle Line, the Technostructure, Operating Core, Support staff and General (Haber & Barriere, 1998, 23-26). It walked through the phases of an assessment, including team preparation and site preparation, senior management briefing, functional analysis (offsite), onsite data collection through the various methods, data analysis, and final report (Haber & Barriere, 1998, p. 32). The research protocol was supplemented with a literature review and a case study.

The O & M method was used extensively from 1998-2004, whereby 10 assessments were undertaken, "… [including] 4 power plants, 2 research facilities, a conversion facility, a mine/mill operation, a design facility, and a follow-up evaluation of the original pilot station." (Phillps, 2008, p. 3).

Another aspect of RSP-0060 was the criteria by which the methods were evaluated, but criteria by which other methods could equally as well be evaluated. These criteria are:

- Capable of Broad-Based Use: It was considered important that the techniques chosen could be utilized in a variety of settings, for a variety of job positions and departments, and be of use in the varied needs of the AECB.
- Objective Measures: It was considered important that the techniques chosen rely on structured and objective observations and not subjective judgements. One criticism of many investigations into the area of organizational performance has been that the results of the investigations are not replicable due to the large degree of subjective judgement inherent in the methodology used for conducting the investigation. By providing methods that are more objective, the collected data and any conclusions drawn from the data are more defensible, replicable, and allow for comparative analysis.(either over time at the same organization, or across organizations).
- Quantitative and Qualitative: Both a quantitative and qualitative assessment of the organizational dimensions under study is important for an adequate understanding of organizational performance. Specifically, quantitative data provides objective measures of the dimensions under study while qualitative data allows for descriptive statements which help in the characterization of the quantitative assessment.
- High Scrutiny and Use: Finally, because the methods are being developed for regulatory application, the methods chosen must be able to withstand substantial peer scrutiny and must have undergone extensive use. (Haber & Barriere, 1998, p. 27)

In 2002, the American Davis-Besse nuclear power station found a significant degradation of the pressure vessel head, and in 2003 Human Performance Analysis (owned by Sonia Haber) performed a safety culture assessment using the methodology introduced in RSP-0060 (Human Performance Analysis, 2003). The Spanish nuclear regulator has also adapted the Canadian Adaptive Machine Model in their Nuclear Organization and Management Analysis Concept in their oversight strategy (Spanish Nuclear Safety Council (CSN), 2017).

In 2004 the CNSC, after having gained some experience with this approach, held a large workshop on Safety Culture. “In March, 2004, the CNSC conducted a Safety Culture Symposium which was held in Toronto. Over 150 delegates comprising industry and a number of regulatory bodies attended the event. All delegates received a CD containing all of the symposium presentations, a draft guidance document for licensees to assess their own safety culture, and a complete copy of the Research Report (RSP-0060) referred to above.” (Phillps, 2008, p. 3)

In 2013, Sandia labs undertook a literature review of safety culture. As part of their review, they looked at Existing Methodologies to Assess Safety Culture (Cole, Kerstan S.; Stevens-Adams, Susan M.; Weneer, Caren A.; Sandia Labs, 2013, p. 31). They recognize the importance of using multiple methods, but also state that there are no standardized tools to assess safety culture that are universally recognized. They state:

> Clearly, both construct validity (the extent to which an assessment instrument actually measures what it is intended to measure) and discriminate validity (the power of an assessment instrument to differentiate between groups that have different levels of safety) are important, and thus is desired to use instruments that have been validated (Weigmann, et al, 2002) in future assessment activities….
> HSS (Office of Health, Safety and Security) is using an established methodology (see Haber and Barriere, 1998) for their assessments, which generally includes five distinct approaches to collecting information about organizational behaviors associated with safety culture traits. These methods include: functional analysis, structured interviews and focus groups, Behavioral Anchored Rating Scales, behavioral observations, and the administration of an Organizational and Safety Culture survey (as an example, see Independent Oversight Assessment of the Nuclear Safety Culture at the Salt Waste Processing Facility Project, 2013). This approach has focused on the following organizational behaviors: Attention to Safety, Communication, Coordination of Work, Formalization, Organizational Learning, Performance Quality, Problem Identification and Resolution, Resource Allocation, Roles and Responsibilities, and Time Urgency.
> Given the existence of such approaches, it seems logical to use these approaches rather than continue to develop unique approaches each time there is a need to assess safety culture. Continuing to use the same approach also allows for easier comparisons over time, and the ability to evaluate the effectiveness of interventions that are put in place. (Cole, Kerstan S.; Stevens-Adams, Susan M.; Weneer, Caren A.; Sandia Labs, 2013, 31-2)

The citation for the "established methodology" is

> Haber, S.B. and Barriere, M.T. (1998). Development of a regulatory organizational and management review method. Research Report RSP-0060, Canadian Nuclear Safety Commission, Ottawa, Canada.

The discussion paper (CNSC, DIS-12-07 Discussion paper on Safety Culture for Nuclear Licensees, 2012) followed the model of and referenced the draft guidance document (CNSC, Draft Guidance for Licensee Self Assessment of Safety Culture, 2004) referred to in the 2004 safety culture symposium. This in turn referenced RSP-0060. These documents informed the present day REGDOC-2.1.2 Safety Culture.

3. Expectations regarding safety culture

This section deals with the articulated expectations regarding safety culture, highlighting the nuclear industry, but also the Canadian regulatory landscape.

3.1 Canadian Nuclear Safety Commission

Legislation

The Canadian Nuclear Safety and Control Act (NSCA) states, in Section 24(4),

> **(4)** No licence shall be issued, renewed, amended or replaced — and no authorization to transfer one given — unless, in the opinion of the Commission, the applicant or, in the case of an application for an authorization to transfer the licence, the transferee
> **(a)** is qualified to carry on the activity that the licence will authorize the licensee to carry on; and
> **(b)** will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed. (Government of Canada, 2017)

Regulation

With respect to the applicable regulation, under Section 3.0, of the General Nuclear Safety and Control Regulations,

> An application for a licence shall contain the following information:
> 3(1)(k) The applicant's organizational management structure insofar as it may bear on the applicant's compliance with the Act and the regulations made under the Act, including the internal allocation of functions, responsibilities and authority. (Government of Canada, 2015)

On Oct 4 2017, Canada Gazette Part II, Vol. 151, No. 20 contained amendments to the Class I Nuclear Facilities Regulations (part of the CNSC's response to the Fukushima Task Force's recommendations) including:

> **Class I Nuclear Facilities Regulations**
> 4 Paragraph 3(d) of the Class I Nuclear Facilities Regulations 42 is replaced by the following:
> (d) the proposed management system for the activity to be licensed, including measures to promote and support safety culture;
> (d.1) the proposed human performance program for the activity to be licensed, including measures to ensure workers' fitness for duty. (Canadian Nuclear Safety Commission, 2017, p. 2586)
>
> **Uranium Mines and Mills Regulations**
> 6 Subparagraph 3(b)(v) of the Uranium Mines and Mills Regulations 53 is replaced by the following:

> (v) the proposed management system for the activity, including measures to promote and support safety culture; (Canadian Nuclear Safety Commission, 2017, p. 2587)

As such, with these amended regulations, the expectation for measures to promote and support safety culture was articulated as a clear expectation – with the words in the regulation itself.

With regulations in Canada Gazette, there is accompanying text justifying the regulatory approach. For the above mentioned amendments, some accompanying text gave more detail on what the expectation for the regulation would mean in practice.

> A management system integrates the organization's various programs, including those for quality assurance, human performance, and security, so that safety is not compromised by other requirements or demands. The management system also ensures the promotion of a safety culture, the regular assessment of safety performance and the application of lessons learned from experience. (Canadian Nuclear Safety Commission, 2017, p. 2595)

Specifically, the expectation communicates holistic integration of and organization various programs, specifically security along with safety, as well as specifically promoting safety culture, and assessment of safety performance. The text further states that "All Class I nuclear facilities and uranium mines and mills currently have management systems in place as a condition of their licence to operate." (Canadian Nuclear Safety Commission, 2017, p. 2603) Thus the expectation for licensees to promote and support safety culture using their management systems was clearly communicated.

Regulatory Documents

REGDOC-2.1.2 Safety Culture, the focus of this review, is the candidate REGDOC to give information on the "why, what and how" regarding safety culture.

3.2 CSA standards

The CSA provide standards to the nuclear industry, specifically on management systems. The most recent of these is CSA N-286-12 – Management System requirements for Nuclear Facilities, colloquially known as "N286-12". The standard was in force effective 2012, although many licensees needed time to transition from the previous version (N286-05).

In N-286-12, there is a specific mention of safety culture in the standard itself. Quoting directly form the standard,

> 4.2 Safety Culture
> Management shall use the management system to understand and promote a safety culture by
> a) issuing a statement committing workers to adhere to the management system
> b) defining and implementing practices that contribute to excellence in worker performance

> c) providing the means by which the business supports workers in carrying out their tasks safely and successfully, by taking into account the interactions between individuals, technology, and the organization; and
> d) monitoring to understand and improve the culture. (CSA, 2012, 5-6)

In this wording, we see the terms understand and promote, and well as monitoring and improve. However, the guidance on how to understand, promote, monitor and improve is very thin in the standard.

3.3 IAEA Documents

The IAEA has many documents devoted to the topic of safety culture, many of which are listed in the proposed REGDOC (CNSC, 2017, 22-23). However, in terms of high level expectations that the IAEA had set out for safety culture, the best document is the seminal work of INSAG 4.

> 3.1. REQUIREMENTS AT POLICY LEVEL
> 16. In any important activity, the manner in which people act is conditioned by requirements set at a high level. The highest level affecting nuclear plant safety is the legislative level, at which the national basis for Safety Culture is set. (IAEA, 1991, p. 5)

This INSAG recommendation motivated a cascade of documents at the IAEA, including Safety Fundamentals 1, which in its 10 principles, outlines the role of governments and the leadership and management for safety including safety culture (IAEA SF 1, 2006).There has been guidance offered on many topics on safety culture, including regulatory oversight (IAEA, 2013) and leadership and management for safety (IAEA GSR Pt 2, 2016).

This IAEA recommendation is to have a very high level policy on safety culture, preferably at the national level. This is the case in Canada, certainly with the most recent Class I regulations amendments. Other countries in the nuclear industry have differing expectations of safety culture.

3.3.1 SRS 83

As the IAEA Safety Report Series 83, Performing Safety Culture Self assessments, is not a document that addresses how member states should incorporate safety culture in their regulatory framework. It is intended to give more autonomy to those undertaking self-assessments.

> This Safety Report adds to that knowledge base in a rather distinct way. It takes an approach that fosters the development of in-house understanding and reflection regarding the organization’s culture, rather than relying solely on external or outside evaluations that compare cultural attributes with international norms. (IAEA SRS 83, 2016, p. Forward)

As such, regarding expectations, SRS 83 is silent on the issue.

3.4 Nuclear benchmarking

Finland

In terms of safety culture in legal expectations, Finland has had this in the nuclear arena for some time.

> One of the first countries to regulate safety culture in the nuclear industry was Finland, where "good safety culture" is required by law in nuclear installations (Government Decree on the Safety of Nuclear Power Plants, 717/2013, 28 §) (Oedewald, Pia; Gotcheva, Nadezhda; Viitanen, Kaupo; Wahlström, Mikael, 2015, p. 33)

This is expanded upon slightly in their country report for the Convention on Nuclear Safety

> The importance of a good safety culture is emphasised in the Nuclear Energy Act and in the STUK Regulation (STUK Y/1/2016) Section 25, which states that when designing, constructing, operating and decommissioning a nuclear power plant, a good safety culture shall be maintained by making sure that the decisions and activities of the entire organisation reflect commitment to operational practices and solutions that promote safety. (Finland - contracting party report, 2016, p. 36)

Hence safety culture is recognized in the Finnish nuclear regulation.

Czech Republic

The Czech Republic Introduced a new atomic law (ACT No. 263/2016 of Coll.), which has a requirement for management systems for licensees including safety culture:

> Licensee "… shall introduce the management system in a manner ensuring that through this system are permanently developed and regularly evaluated characteristics and attitudes of persons performing activities related to the use of nuclear energy and activities in exposure situations and of their personnel, which ensure that nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management and security are approached with a seriousness corresponding to their importance (hereinafter „safety culture")." (Doležal, Radim; State Office for Nuclear Safety (Czech Republic), 2017)

Thus for the Czech Republic, safety culture is also in formal legal requirements.

Switzerland

Unlike the countries above, Switzerland has chosen not to put safety culture in law, but to have a high level policy on safety culture in guidelines.

> ENSI has formulated very general requirements concerning safety culture in its guideline on the Organisation of Nuclear Installations G07 (https://www.ensi.ch/en/documents/g07-the-organisation-of-nuclear-installations/) (cf. section 4.4). Our assumption and basic principle is that

> safety culture cannot be regulated in detail in laws and guidelines and cannot be prescribed by the regulatory body.
> (Section 4.4) Measures for the purpose of observing, assessing and fostering a good safety culture must be incorporated in the management system. (Holger, Knissel;ENSI (Switzerland), 2017)

As in the other legally based safety culture regulations, this guideline also stipulates the importance of the management system for "fostering a good safety culture".

United States

As Switzerland, the US NRC has a different approach than regulation; they have a safety policy. The programme in the US is described below.

> The NRC's approach to safety culture is based on the premise that licensees bear the primary responsibility for safety. The NRC addresses safety and security through expectations detailed in policy statements, procedures and regulations, including the NRC's Safety Culture Policy Statement (SCPS), the Reactor Oversight Process (ROP), and the Allegation and Enforcement Programs.
>
> The NRC's SCPS sets forth the Commission's expectation that individuals and organizations establish and maintain a positive safety culture commensurate with the safety and security significance of their activities and the nature and complexity of their organizations and functions. The SCPS is not a regulation. It applies to all licensees, certificate holders, permit holders, authorization holders, holders of quality assurance program approvals, vendors and suppliers of safety-related components, and applicants for a license, certificate, permit, authorization, or quality assurance program approval, subject to NRC authority.
>
> Licensees are made aware of NRC expectations through publication of Federal Register Notices in the Federal Register. The NRC is a transparent regulator and all Policy Statements, procedures, processes, etc. that apply to licensee oversight are available in the NRC's Agencywide Documents Access and Management System (ADAMS) which is the official recordkeeping system. There are also other vehicles used to provide notifications such as Regulatory Information Summary documents or NUREGs.
>
> The NRC publishes Regulatory Information Summary (RIS) documents that address expectations as well as NUREGs that address expectations. One NUREG of note in the safety culture area is NUREG-2165, "Safety Culture Common Language" which provides descriptions of safety culture traits and behavior examples. The NRC has a robust safety culture website which has numerous examples of educational resources for all licensees to utilize to inculcate a positive safety culture into their organization to assist in meeting NRC expectations in the NRC's Safety Culture Policy Statement. That website is found at: https://www.nrc.gov/about-nrc/safety-culture.html (Sieracki, Diane; NRC (United States), 2017)

> Licensees perform periodic, voluntary self-assessments of safety culture in accordance with industry guidelines. There are no regulatory requirements for licensees to perform safety culture assessments routinely. However, depending on the extent of deterioration of licensee performance, the NRC has a range of expectations about regulatory actions and licensee safety culture assessments... As part of the assessment process, the NRC considers the aspects of safety culture components associated with inspection findings to determine whether common themes exist at a plant. If, over three consecutive assessment periods (i.e., 18 months), a licensee has the same safety culture issue with the same common theme, the NRC may ask the licensee to conduct a safety culture self-assessment. (US - contracting party report, 2016, p. 127)

A few points are noteworthy about this approach. One, that the licensees bear the primary responsibility for safety (as is true in Canada). Secondly, that safety and security are jointly articulated in the safety culture policy statement. Thirdly, the policy statement applies to all licensees and those who interface with them (suppliers and vendors). Fourth, that the expectations are widely disseminated through their registrar, and fifth, that the NRC provides guidance to the licensees to promote a healthy safety culture in their organizations, even though there is no requirement for periodic self-assessments of safety culture (although they can require one should the NRC believe the culture has sufficiently deteriorated).

Other nuclear power plant countries

Other countries with nuclear power plant regulators have an expectation that the licensee establish policies on safety culture with a means to promote high achievement in performance. India has such an expectation “Among others, the responsibility of the licensee is to: […] x. establish policies to achieve high standards of safety and promote safety culture in the organisation.” (India - contracting party report, 2016, p. 58). Spain also has this expectation, “Licensees are required to promote and improve a healthy SC, through SC Evaluation and Improvement Programs... The CSN doesn’t consider the “security culture” as a concept that is independent from Safety Culture. On the contrary, the focus has been the understanding of Safety Culture as the Organizational Culture of an organization whose main focus must be the safety of the nuclear installation, to which all types of safety contribute, one of them being physical security.” (Barrientos, Marta; Gil, Benito; CSN (Spain), 2017)

Overall, other nuclear regulators do have articulated, wither in law or in policy, the expectation that licensees respect the importance of safety (and security) culture in their facilities.

3.5 Other Canadian industry benchmarking

All Canadian industry benchmarking regarding expectations for safety culture was done through Canada Gazette Part II (official regulations with additional text justifying the regulatory approach).

Aviation – Transport Canada

The Aviation industry was the first in Canada to establish safety management systems in 2007, with an aim to "foster stronger safety cultures in the aviation industry". Below is an extract from the Regulatory Impact Analysis Statement for the "Regulations Amending the Canadian Aviation Regulations (Parts I, III and VIII)".

> Safety management systems are based on the fact that there will always be hazards and risks, therefore proactive management is needed to identify and control these threats to safety before they lead to mishaps. The expected result of this initiative is the fostering of stronger safety cultures within the civil aviation industry and, as a consequence, the improvement of safety practices. (Transport Canada, 2007, p. 2671) (emphasis added)
> Transport Canada has developed a proactive, flexible enforcement policy with which to approach the evolving safety framework introduced with the safety management system. Transport Canada will not compromise safety, nor ignore any contraventions of the regulations, but will encourage the development of a safety culture as an essential element of the SMS framework. (Transport Canada, 2007, 2683-4) (emphasis added)

As can be clearly seen, the intent of the SMS regulation was to have the civil aviation industry recognize the importance of safety culture to their operations.

Oil and Gas - National Energy Board

The next regulator to mention safety culture in its regulations was the National Energy Board in 2013.

> The Regulations contain new administrative requirements to ensure safety outcomes. They are related **to the safety culture of a management system** and focus on accountability for the company's safety performance. (National Energy Board, 2013, p. 819) (emphasis added)

The management system and safety culture are mentioned jointly, with an aim of improved safety performance.

Rail – Transport Canada

The rail industry introduced safety management regulation in 2015.

> **Safety management systems also strengthen corporate safety culture** and demonstrate corporate due diligence, thus improving an organization's overall level of safety in the long term. (Transport Canada, 2015, p. 619) (emphasis added)

They further explain that safety culture is linked with continuous improvement,

> … Transport Canada has decided that **developing a safety management system to increase safety culture and continuous improvement is important for all companies**. The safety management system developed will be scalable to the size and nature of operations and Transport Canada is developing tools, templates and guidance to help ease the burden of implementation. (Transport Canada, 2015, p. 625) (emphasis added)

And that a compliance approach is not sufficient:

> In addition, **companies implementing safety management systems should not only be looking to comply with the Act and its related instruments, but should also be working to build a safety culture throughout their organization to achieve the highest level of safety**. (Transport Canada, 2015, p. 627) (emphasis added)

Furthermore, they realized that a graded approach needed to be taken for the breadth of railways in the Canadian rail industry, and that even small railways still needed to have some core aspects of the safety management system to "instill a safety culture",

> Industry pointed out that requiring local railway companies who operate on non-main track to comply with the full suite of regulatory requirements would be overly burdensome and costly for what would usually be a smaller or limited railway operation. Rail Safety inspectors and officials acknowledged that the risk represented by such companies on non-main track did not warrant the development and implementation of a full safety management system, but **that certain core aspects be applied as a means of instilling a safety culture** in those companies. (Transport Canada, 2015, p. 622) (emphasis added)

Marine – Transport Canada

The last main modality of transport regulated by Transport Canada, marine, introduced its safety culture promoting safety management system regulation in 2016.

> These amendments are designed to contribute to the promotion of a safety culture by modernizing the requirements for fishing vessels without creating unnecessary economic barriers or undue hardship to fishers or communities that depend on fishing. (Marine Safety and Security, 2016, p. 2662)(emphasis added)

Thus, by mid-2016, Transport Canada had safety culture in the regulatory requirements of safety management systems for the three main modes of transport.

Accreditation Canada

While not a traditional regulator in the sense of Transport Canada, the National Energy Board, or the Canadian Nuclear Safety Commission, Accreditation Canada does have influence in the healthcare industry. In its 2017 Required Organizational Practices Handbook 2017 - Version 2, **Safety Culture is one of 6 Required Organizational Practices** in the Accreditation Canada Qmentum program. (Accreditation Canada, 2017) (emphasis added)

3.6 Other international industry benchmarking

Norway Oil and Gas

All the information of this section comes from the National Energy Board publication "A Regulator's Guide to Culture and Leadership" by Mark Fleming and Natasha Scott.. (Fleming & Scott, n.d., 48-49)

Pre-dating the Canadian regulatory experience with safety culture, Norway introduced safety culture in its regulations in 2002; their experience is worth learning. Originally, the regulations read as follows:

> The party responsible will encourage and promote a sound health, safety and environment culture comprising all activity areas, and which contributes to achieving that everyone who takes part in petroleum activities takes on responsibility in relation to health, safety and the environment, including also systematic development and improvement of health, safety and the environment.

However, this wording turned out to be problematic. Unions, some researchers, and some Petroleum Safety Authority's internal experts noted that "everyone who takes part in petroleum activities takes on responsibility in relation to health, safety and the environment" had been interpreted to refer exclusively to those at the front line of oil and gas production rather than the ensemble of the company, specifically senior leaders. The authors note that "this view misses the fundamental aspect of safety culture, which is the shared nature of culture" and that "The revised regulation and guidance highlights the importance of culture in risk management in the broadest sense, from preventing occupational injury to major disasters".

The revised regulation, introduced in 2011, states:

> A sound health, safety and environment culture that includes all phases and activity areas shall be encouraged through continuous work to reduce risk and improve health, safety and the environment.

Hence, some experience with the regulation was essential in order to ensure the important aspects were captured – that is, that safety culture applies to everyone in the organization, and that is covers aspects form occupational health and safety to major disasters.

It is worth noting that both these aspects are taken into consideration in the proposed REGDOC, both in the introduction. Specifically,

> "All workers, from senior managers downwards, have a shared responsibility to ensure that a healthy safety culture is a priority." (CNSC, 2017, p. 1)

and

> "The approach, however, is holistic, and not restricted to only occupational health and safety." (CNSC, 2017, p. 1)

3.7 Summary

REGDOC-2.1.2 Safety Culture outlines expectations that other regulators, both within and outside the nuclear industry, have had for some time.

4. Requirement 1 - Fostering Safety Culture through a Formal Commitment

This section deals with having a documented commitment to foster safety culture in the governing documentation.

4.1 REGDOC contents

(Requirement statement)

This section contains requirements and guidance applicable to all Class I facilities, and Uranium Mines and Mills.

Licensees shall document their commitment to fostering safety culture in their governing documentation.

This section provides information for all other licensees.

(Guidance)

Section 2.1 – Safety culture governance documentation
Principle 1 reads “Every organization has a safety culture,” which should be reflected in an organization’s governing documentation. Licensees are responsible for fostering a healthy safety culture through promoting and reinforcing a collective commitment to safety that is responsive to the risk and complexity of the licensed activities. To achieve this, licensees should use all available avenues, including a reliance on governing documentation (e.g.., policies, processes, procedures, and manuals) to define and manage safety goals and performance objectives. This helps provide context to the requirements concerning safety culture found in CSA standard CSA N286, Management system requirements for nuclear facilities [3].

The highest level of governing documentation should make safety the utmost priority – overriding the demands of production and project schedules and forming a basis for promoting a healthy safety culture, including a questioning attitude and a commitment to excellence in the performance of all activities important to safety. Governing documentation may describe the leadership role(s) encompassing the highest levels of responsibility for safety matters, as well as areas where workers share safety responsibility. Leaders may use governing documentation to demonstrate key safety behaviours to workers, while ensuring workers understands their defined safety responsibilities, goals and performance objectives. Promoting and reinforcing a collective commitment to safety includes the continual improvement and practical use of all governing documentation. (CNSC, 2017, p. 6)

The REGDOC speaks of the governing documentation as the place where the formal commitment to safety culture resides. This is likely in an overriding policy in the organization's management system, from which all formal organizational structure is derived. It is a governance policy, so that all documentation that needs to ensure a collective commitment to safety (other policies, procedures, work organization tools, etc.) has a safety culture policy in the highest level of the governance documentation which can be easily found and similarly easily referenced. This is will aid in ensuring that safety is routinely seen as important and integrated into all practices.

4.2 CSA standard

As mentioned, the CSA standard N 286-12 outlines the necessity of a management system, and how it is used to foster safety culture.

> 4.2 Safety Culture
> Management shall use the management system to understand and promote a safety culture by
>
> > a) issuing a statement committing workers to adhere to the management system
> > b) defining and implementing practices that contribute to excellence in worker performance
> > c) providing the means by which the business supports workers in carrying out their tasks safely and successfully, by taking into account the interactions between individuals, technology, and the organization;… (CSA, 2012, 5-6)

Given that the standard states specifically that a statement must be issued to "adhere to the management system", and that the management system must be used to "understand and promote a safety culture", a documented commitment to the importance of safety culture is entirely consistent with the CSA standard. N 286-12 also details how the management system should enable a business to "support workers" and "contribute to excellence in worker performance", which is how the management system is implicated in safety culture fostering beyond the documented commitment.

4.3 IAEA Documentation

The seminal document INSAG 4 stipulated the importance of the safety culture policy.

> In its manifestation, Safety Culture has two major components: the framework determined by organizational policy and by managerial action, and the response of individuals in working within and benefiting by the framework. Success depends, however, on commitment and competence, provided both in the policy and managerial context and by individuals themselves. (IAEA, 1991, p. 2)

There is a list of requirements in the document, the policy being one of them.

> 20. An organization pursuing activities with a bearing on nuclear plant safety makes its responsibilities well known and understood in a safety policy statement. This statement is provided as guidance to staff, and to declare the organization's objectives and the public commitment of corporate management to nuclear plant safety. (IAEA, 1991, p. 7)

Hence from the early days of safety culture, a formal declaration of the importance of safety culture has been recognized.

More recently, this has been reiterated in GSR Part 2, “The management system also has to ensure the fostering of a strong safety culture, the regular assessment of safety performance and the application of lessons from experience” (IAEA GSR Pt 2, 2016, p. 2). This is explained further in subsequent sections.

> OBJECTIVE
> 1.9. The objective of this Safety Requirements publication is to establish requirements that support Principle 3 of Fundamental Safety Principles [1], in relation to establishing, sustaining and continuously improving leadership and management for safety, and an effective management system. This is essential in order to foster and sustain a strong safety culture in an organization. (IAEA GSR Pt 2, 2016, p. 4)
> **Requirement 6: Integration of the management system**
> 4.9. The management system shall be applied to achieve goals safely, to enhance safety and to foster a strong safety culture by:
> (a) Bringing together in a coherent manner all the necessary elements for safely managing the organization and its activities;
> (b) Describing the arrangements made for management of the organization and its activities;
> (c) Describing the planned and systematic actions necessary to provide confidence that all requirements are met;
> (d) Ensuring that safety is taken into account in decision making and is not compromised by any decisions taken. (IAEA GSR Pt 2, 2016, p. 10)

The expectation of the use for the management system for fostering a healthy safety culture is further explained in a later section.

> Requirement 12: Fostering a culture for safety
> Individuals in the organization, from senior managers downwards, shall foster a strong safety culture. The management system and leadership for safety shall be such as to foster and sustain a strong safety culture. (IAEA GSR Pt 2, 2016, p. 15)

Hence the use of the management system to foster safety culture is in expectations set out by the IAEA.

4.3.1 SRS 83

The IAEA document on self-assessing safety culture also addresses the importance of the safety policy in governing documentation.

> Management for safety: This includes the management system, which is the formal normative framework, for achieving the desired practices and outcomes, such as policy and strategy, regulatory framework, processes, procedures, risk management, organizational structure, and management programmes and plans. (IAEA SRS 83, 2016, p. 11)

While not its main focus, SRS 83 also mentions the management system, the policy, and the overall formalized management structure, and its importance to safety culture.

4.4 Literature

The importance of the management system, specifically an articulated policy on the importance of safety culture, has been echoed in the literature. A statement of safety policy is the highest element of those named in establishing a radiation safety culture (Mod Ali, 2008, p. 625). "The overriding importance attached to nuclear safety is reflected in the mission, the vision and the values of the company. These are identified in the Integrated Management System" (Mariscal, Herrero, & Otero, 2012, p. 1243). Guldenmund identifies how the management system is the core of the safety culture infrastructure.

> The SMS of an organization is the obvious arrangement to control and monitor these processes and to ensure that they are present, well executed, and the subject of continuous scrutiny and improvement, when necessary. Supported by an appropriate structure, this framework as well as its constituent processes will be able to invoke and ensure the safety behavior that is required and desired, at least to a certain extent.14 The SMS then embodies the organizational structure and processes, which are empowered or driven by the motor of the safety culture to produce the safety performance (behavior) of the system. (Guldenmund F. W., (Mis)understanding Safety Culture and Its Relationship to Safety Management, 2010, p. 1477)

However, the management system is necessary, but not sufficient, to ensure that safety culture is fostered. "Lee and Harrison (2000) reveal that basically, any safety management system is a social system, wholly reliant upon the employees who operate it. Its success depends on three things: its scope; whether employees have knowledge about it; and whether they are committed to making it work" (Choudhry, Fang, & Mohamed, 2007, 998-999). This is expanded in the context of a power plant below.

> Having a 'safety first' policy as a strategy does not guarantee that it will become an operational reality in NPPs, where profitability tends to compete with non-productive investments in nuclear safety (Perin, 2005). The IAEA (1999) warns that there are times when the emphasis on safety might come into conflict with the requirement to meet all the demands for electricity generation. What happens in these situations? Is safety still the number one priority when money comes into play? Or are NPPs taking risky cost-cutting measures (e.g. deferring maintenance, downsizing staff, reducing training, etc.) to cope with competitive pressures (Meshkati et al., 2001)? The practical importance of safety will be reflected in the decisions NPPs' leaders make when facing these competing demands. The extent to which safety is favored over productivity when they come into direct conflict will allow organizational members to align their behaviors accordingly (Zohar and Hofmann, 2012). (de Castro, Gracia, Tomása, & Peiróa, 2017, p. 47)

While the management system that houses the documented commitment to safety culture is important, it alone is not enough. How this commitment is understood throughout the organization, especially in times of pressure, is how the organization embodies safety

culture. The "operational reality" referred to in the above quote is what truly counts – how safety is realized at every level in the organization, particularly when competing values may be at play, is the true incarnation of the documented commitment to safety culture in the governing documentation.

4.5 Nuclear benchmarking

Belgium

The Belgian regulatory authority looks at Safety culture observations … through four key safety dimensions: i.e. management system, leadership, human performance and learning. For each of these dimensions, observed safety culture strengths and weaknesses are yearly discussed with licensees (Bernard, Benoît; Bel V (Belgium), 2017). In terms of licensees, "The ENGIE Electrabel approach for implementing "Safety Culture" is based on four elements, the Nuclear Safety Policy, the Management System, the Global Plan for Nuclear Safety and the Human Performance Programme. The way to implement the principles defined in the Nuclear Safety Policy is described in the management system. The role, responsibilities and accountabilities of each level of the management regarding nuclear safety are clearly defined by following the INSAG-4 "Safety Culture" from IAEA" (Belgium - contracting party report, 2016, p. 49).

Belgium does recognize the importance of a safety policy and a management system for the development of safety culture.

Bulgaria

> The Regulation on Ensuring the Safety of Nuclear Power Plants requires the operating organization to adopt a document - Safety Policy, which shall give highest priority to safety over all other activities, and assume a clear commitment to continuously improve safety, and encourages staff to have critical attitude towards the works they do, to support and encourage thinking and behaviour leading to high level of safety culture. The staff and contractors who perform activities that have an impact on safety shall be made familiar with the safety policy.
> To implement the Safety Policy, the licensee shall develop directives for its application and monitoring of activities with clearly defined objectives and intentions that can easily be controlled and monitored by the management. The Policy shall require continuous improvement of nuclear safety by means of:
> - Continuous process of safety reassessment, taking into account operating experience, research and safety analyses and the achievements of science and technology;
> - Timely implementation of practically possible improvements;
> - Use in a timely manner of substantially new information related to the safety of the nuclear plant. (Bulgaria - contracting party report, 2016, p. 43)

Bulgaria also recognizes the importance of a safety policy in the management system for the development of safety culture.

China

> In 2014, the Regulator (MEP - NNSA), National Energy Administration and China Atomic Energy Authority jointly issued the Nuclear Safety Culture Policy Statement. This statement revealed the connotation of nuclear safety and nuclear safety culture, expounded the eight main features of cultivating and practicing good nuclear safety culture, and advocated cultivating, practicing and continually promoting nuclear safety culture. The issuance of the Nuclear Safety Culture Policy Statement pointed out the direction for promoting the cultivation of nuclear safety culture and enhancing the nuclear safety culture quality of people working in the nuclear industry. (China - contracting party report, 2016, p. 11)

China's documented commitment is realized in the Nuclear Safety Culture Policy Statement.

Czech Republic

> The Czech Republic Introduced a new atomic law (ACT No. 263/2016 of Coll.), which has a requirement for management systems for licensees including safety culture:
> Licensee "… shall introduce the management system in a manner ensuring that through this system are permanently developed and regularly evaluated characteristics and attitudes of persons performing activities related to the use of nuclear energy and activities in exposure situations and of their personnel, which ensure that nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management and security are approached with a seriousness corresponding to their importance (hereinafter „safety culture")." (Doležal, Radim; State Office for Nuclear Safety (Czech Republic), 2017)

Thus for the Czech Republic, safety culture is realized through the establishment of a management system.

France

The regulator, ASN, uses the term "safety culture" very rarely. It will be used for the first time in an ASN guide on the integrated management system, planned to be published in 2018 (Nouailles-Mayeur, Anaïs; ASN (France), 2017). The licensee also detailed its approach

> Given the importance of all EDF's nuclear activities and its responsibilities and involvement in the reactor operations in France, but also in Great Britain, the EDF Group adopted a Nuclear Safety Policy in 2012, which applies to all its activities within each Group company operating nuclear facilities (design and construction of new projects, operation of existing reactors, maintenance, waste management, dismantling, engineering). This policy, which is inspired by international guidelines and safety requirements (IAEA SF-1 and GSR-3, INSAG 4 for

> the safety culture, INSAG 13 for safety management, INSAG 18 for change management), (France - contracting party report, 2016, 81-82)

In France, although safety culture is rarely used, the integrated management system could house the holistic Nuclear Safety Policy, which "applies to all activities", and is inspired by IAEA documents which speak of safety culture.

Germany

> With the introduction of § 7c AtG (2011), the licence holder also became legally required to introduce a management system giving due priority to safety. In the non-mandatory guidance instruments, the "Safety Requirements for Nuclear Power Plants" contain fundamental organisational requirements for the management of the corporate enterprise operating, amongst others, the nuclear installation for electricity production as well as for the management of the installation itself. This also includes the integrated management system (IMS), in which all safety-related objectives and requirements have to be considered, and it contains the task given to the licence holder to maintain a highly developed safety culture and to continually improve the latter. (Germany - contracting party report, 2016, p. 78)

In Germany, the integrated management system is to maintain and continually improve a highly developed safety culture.

Spain

The CSN requires CSN IS-19 "Integrated Management Systems": require the licensees to promote and improve a healthy Safety Culture, including periodic Safety Culture assessment and CSN IS-26 "Basic Nuclear Safety Requirements": require the licensees to stablish a framework for a healthy Safety Culture. The main reference used is the IAEA, in terms of the Safety Culture model and the integration of Safety Culture in the Management Systems. The IAEA documents are used by both licensees and regulator to develop/meet the requirements related to Safety Culture. (Barrientos, Marta; Gil, Benito; CSN (Spain), 2017)

Thus Spain also uses an integrated management system to foster safety culture.

Switzerland

> Guideline ENSI-G0718 stipulates that measures must be incorporated within the management system in order to observe, assess and promote a good safety culture. In the management system, the nuclear installation must be described as a socio-technical system consisting of three components: humans, technology and organisation. When considering this system, account must be taken not only of its individual components and their interactions, but also of external influences on the system (of an environmental, social, political and cultural nature).
> A management system that is backed and implemented by management should guarantee:
> - a shared understanding of the characteristics of a good safety culture
> - adequate resources for the employees to carry out their tasks safely

- methods to prevent errors and to enable learning from experience
- continuous, ongoing development of the safety culture

> In its Safety Standards, the IAEA stipulates a management system that fosters and supports a good safety culture.19 IAEA Safety Guides GS-G-3.120 and GS-G-3.514 include additional recommendations on how the safety culture in the organisation and in the management sys-tem should be taken into account.
> The management system is deployed as an instrument to exert a positive influence on the organisation's safety culture. It should impact the physical environment, the behaviour of the employees and their values and world views in a manner that promotes safety (cf. figure 2). Furthermore, the management system and the way it is implemented on a day-to-day basis are themselves expressions and results of the prevailing safety culture. (ENSI, 2016, p. 14)

Switzerland also requires a management system "as an instrument to exert a positive influence on an organization's safety culture."

United States

As a part of its escalation of regulatory enforcement, safety culture governing documentation of licensees would be seen by inspectors. (Sieracki, Diane; NRC (United States), 2017)

Other NPP Countries (India, Pakistan, Romania and Ukraine)

Reference to safety culture that stems from a safety policy is evident in India (India - contracting party report, 2016, p. 68), Ukraine (Ukraine - contracting party report, 2016, p. 21), Pakistan (Pakistan - contracting party report, 2016, p. 67) and Romania (Romania-contracting party report, 2016, p. 53). Thus a documented commitment to fostering safety culture is evident in these NPP countries.

Non NPP countries (Australia, Indonesia, Lithuania)

Australia requires a commitment to safety culture from its licensees and applicants (Australia - contracting party report, 2016, p. 16), Indonesia similarly requires safety policies including the development of safety culture in a "process oriented management system" (Indonesia - contracting party report, 2016, p. 26), and Lithuania requires an integrated management system that "encompasses all organizational components (including its structure, resources, processes and safety culture)" (Lithuania - contracting party report, 2016, p. 6).

4.6 Other industry benchmarking

Many other industries value a documented commitment to safety culture.

In the air industry, safety culture should "be considered on multiple layers of the organization, such as fundamental values, the organizational system itself (mission, strategy, policy, and procedures)…" (Heese, 2012, p. 27). However, the management system may or may not be essential. "[A] strong Safety Culture is generally considered as a vital condition to a well-functioning SMS. It is sometimes said that is it is well possible

to have a good Safety Culture without a formal SMS, but is not possible to have an effective SMS without a good Safety Culture" (Piers, Michel; Montijn, Carolynne; Balk, Arjen, 2009, p. 4). The safety management system and safety culture are seen as more inter dependent in the rail domain.

> A positive Safety Culture can be a strong enabler to ensure the SMS works in practice. The reverse can also be true: implementing a good SMS can be an enabler for Safety Culture. Organisations are managed by organisational practices, which affect both performance and reliability of safety systems. A well-developed SMS can therefore serve as an accelerator of Safety Culture (Reason 1993, 1997). Therefore SMS and Safety Culture are inter-dependent: SMS embodies the competence to achieve safety, whereas Safety Culture represents the commitment to achieving safety…Defining the safety culture model and the tools/drivers for achievement: SMS already provide effective input: management commitment, organisational learning, involvement of staff, etc. should be documented and become practice in the company. (González, Esteban Coito; Patacchini, Anna; European Railway Agency, 2013, p. 16; 26)

Hence documentation that becomes practice is the strategy for safety culture inculcation. In marine, "the goal of the ISM Code, and of Safety Management Systems (SMS's) is the attainment of peak safety performance (i.e., no operational incidents, no personal injuries, and no harm to the environment), but the maritime industry is still some way from achieving this goal…[T]he industry needs a better understanding of social and organizational factors that foster professionalism in the seafarer in routine and emergency situations" (Bhattacharya, 2015, p. 56). In public transportation, "A clear statement of management commitment makes explicit management's intention to support continuous improvement of safety culture" (NAS Transit Cooperative Research Program Report 174, 2015, p. 58) Referring to a specific example, "Georgia Ports Authority began with the overarching policy conclusion that it is important to have a safety strategy that becomes a natural way of conducting business. "World-class organizations do have a compelling safety vision that is documented, known by all, displayed, and cascades into personnel action"" (NAS Transit Cooperative Research Program Report 174, 2015, p. 130). The understanding that policy must be supplemented with implementation is seen in the trucking industry (NAS Commercial Truck and Bus Safety Synthesis Program Synthesis 14, 2007, p. 32).

In the oil and gas industry, the importance of a written statement regarding safety culture is recognized (Haghighi, et al., 2017, p. 84; NAS Transportation Research Board | Special Report 321, 2016, p. 3), although the caveats of having something on paper but not implemented in practice is also appreciated (NAS Transportation Research Board | Special Report 321, 2016, 30-31; Fleming & Scott, n.d., p. 12). Specifically, "… the [Health and Safety Executive] HSE culture paragraph was never intended as a prescriptive rule and has not been enforced like one. It has the characteristics of a policy statement, stating clearly that authorities and the society at large expect nothing but the best when it comes to prioritizing safety at all levels of the industry. … It should be seen as emphasizing continuous improvement" (Antonsen, Nilsen, & Almklov, Regulating the

intangible. Searching for safety culture in the Norwegian petroleum industry, 2017, p. 238). The positon is best articulated in a NAS report.

> Regulatory actions such as ….[a] Safety Culture Policy Statement reflect regulators' awareness of the importance of safety management and safety culture in preventing catastrophic accidents. However, having safety management systems is necessary, but not sufficient, for having a robust safety culture…. An effective [management system] cannot rely on checklist compliance; the program must become ingrained in the operation's management structure to be successful. The tenets of [management system] must be fully acknowledged and accepted by workers and be motivated from the top. Only then can an effective culture of safety be established and grow….The management systems in an organization direct attention toward strategic goals and priorities, one of which is safety. The organization's culture needs to be aligned with and help support and reinforce the management systems, and safety culture is no exception. Thus, neither safety nor culture can be managed independently from the other management systems. Safety, culture, and safety culture need to be understood as part of these management systems and therefore should not be delegated to a standalone unit (e.g., a safety culture assessment group) that is not highly integrated with the other core operating systems of the organization (Wears et al. 2005; Dekker 2014) (NAS Transportation Research Board | Special Report 321, 2016, 102-3; 140)

This also highlights the integration of the policy into 'the way the organization does business', not to be relegated to a specific department's responsibility, or to a checklist.

In healthcare, patient safety has been a vexing issue for decades, although "The IOM committee recommended that healthcare organizations create an environment in which culture of safety is an explicit organizational goal, becomes a top priority, and is driven by leadership (Kohn, Corrigan, & Donaldson, 2000)." (Sammer, Lykens, Singh, Mains, & Lackan, 2010, p. 156) This written goal has been echoed in the literature (Fleming & Wentzell, 2008, p. 12; Klemenc-Ketis, et al., 2017, p. 2). The overall approach has not yielded the intended outcome, however.

> Faced with the persistent challenge of hospital errors, policy makers and practitioners need guidance regarding how to achieve improvement. We have argued that piecemeal initiatives are inadequate and that strengthening safety culture necessitates interventions that simultaneously enable, enact, and elaborate it in a way that is attuned to the existing culture. This approach may hold the key to demonstrably reducing hospital errors and ultimately saving lives. (Singer & Vogus, 2013, p. 388)

Some specific system-level changes include governance and reporting structures. (Weaver, et al., 2013, p. 3; El-Jardali, Dimassi, Jamal, Jaafar, & Hemadeh, 2011, 10-11). These changes, though, need to take into account the existing cultures, as they may be in conflict with professional understandings (Flin, 2007, p. 662).

NASA has a written commitment to "protect the safety and health of the general public and all elements of the workforce as well as preventing damage or destruction of high-value assets" (NASA, 2015, p. 14) as has an NAS report on academia "Recommendation 4: University presidents and chancellors should establish policy and deploy resources to maximize a strong, positive safety culture" (NAS Committee on Establishing and Promoting a Culture of Safety in Academic Research Laboratories, 2014, p. 4). The US forest fire fighting service, as others, recognize that a policy alone is not enough.

> Effective leadership must go beyond simply issuing directives and policy statements. The members of a fire and emergency service organization can generally differentiate between policies that are intended to satisfy a duty or responsibility and legitimate efforts to lead the organization in a specific direction. There are many examples of fire and emergency service organizations that have issued policies that are based on recommended safety and health standards and then failed to demonstrate a true commitment to those policies. (U.S. Fire Administration, 2015, p. 16)

4.7 Summary

A documented commitment to fostering safety culture is often recognized through an organization's management system. This commitment must be followed through from the documented articulation to the habituated practice. This has been noted throughout industries that recognize the importance of safety culture.

5. Requirement 1 - Fostering Safety Culture through Ongoing Monitoring

This section deals with a very important aspect of fostering safety culture – that of monitoring safety culture on a continual basis.

5.1 REGDOC contents

> (Requirement statement)
>
> This section contains requirements and guidance applicable to all Class I facilities, and Uranium Mines and Mills.
>
> Licensees shall document their commitment to fostering safety culture in their governing documentation.
>
> **This section provides information for all other licensees.**
>
> (Guidance)
>
> Section 2.2 - Ongoing monitoring of safety culture
>
> Principle 4 reads "Safety culture needs to be assessed and monitored to achieve the common goal of understanding the organization's safety culture and limiting risk." Ongoing (essentially continuous) monitoring is a key activity to fostering a healthy safety culture. Monitoring safety culture provides management the means as to how safety manifests itself in everyday discussions, decisions and actions. Licensees have many processes and activities providing insight on safety culture, some of which are listed below. These should be periodically viewed, through the licensee's management review processes, with a safety culture lens, aiming to increase awareness of the organization's safety culture. Where monitoring activities identify improvement opportunities, consideration should be given to prioritizing and implementing these improvements. (CNSC, 2017, 6-7)

The REGDOC then goes on to list possible sources of information to consult to enable continual monitoring.

5.2 CSA Standard

N-286-12 has specific wording on continuous monitoring to foster safety culture.

> 4.2 Safety Culture
> Management shall use the management system to understand and promote a safety culture by …
>
> > d) monitoring to understand and improve the culture. (CSA, 2012, pp. 5-6)

Thus, the standard that is familiar to all Class I nuclear facility licensees already articulates the expectation of "monitoring to understand and improve the culture"; however, how this can be accomplished is not well described in the standard.

5.3 IAEA Documents

5.3.1 SRS 83

While SRS 83 is focused on self-assessments of safety culture, it does acknowledge that outside dedicated self-assessment activities, ongoing monitoring of safety culture is a critical process in the overall aim of fostering safety culture.

> In addition to periodic, in-depth SCSAs, it is important to carry out ongoing monitoring of safety culture as part of plant oversight processes. Other types of assessment method, such as peer and independent assessments, also need to be used to obtain different perspectives. (IAEA SRS 83, 2016, p. 17)

Nuclear Industry Documents

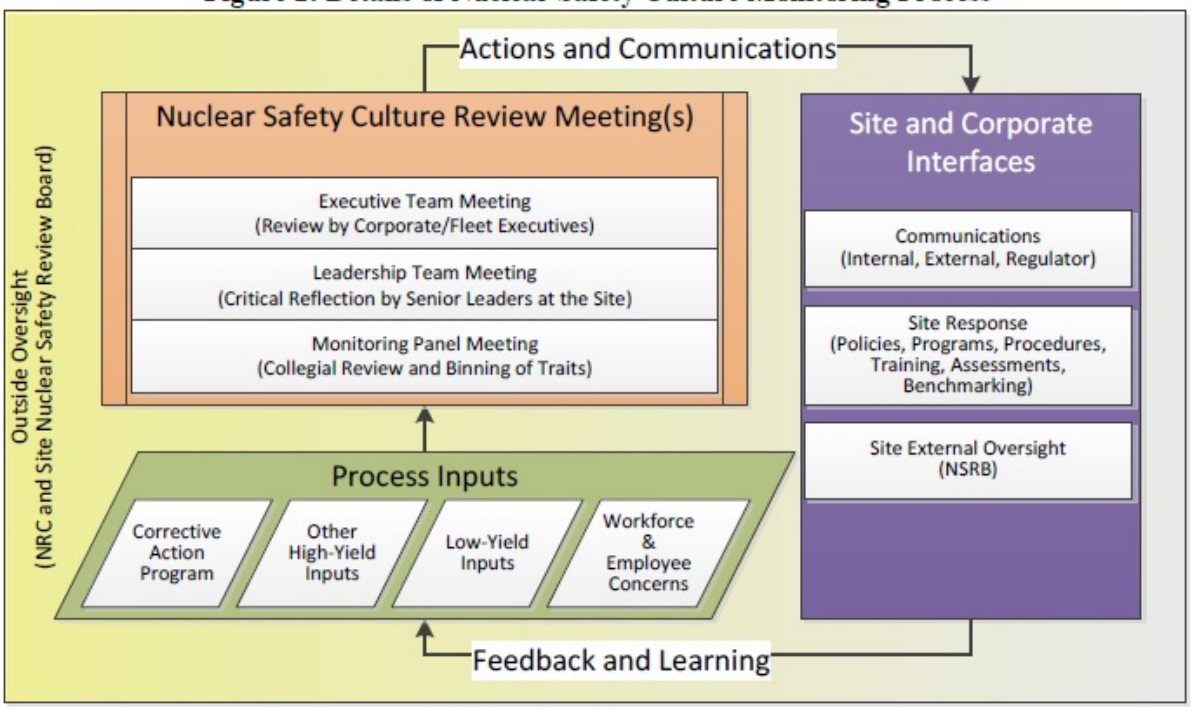
The Nuclear Energy Institute released a document in 2014 which focused almost exclusively on continual monitoring. Entitled "NEI-09-07, Fostering a Healthy Nuclear Safety Culture", the document describes in some detail how a nuclear power plant should conduct ongoing monitoring, although stresses the guidance should be customized to each nuclear power plant's situation.

It justifies why monitoring it important,

> Even though nuclear safety culture is an intangible concept that cannot be measured simply through quantitative means, it is possible to monitor the health of an organization's nuclear safety culture by monitoring observable behaviors. When deviations from expected behaviors are noted, it is the obligation of the organization to promptly and thoroughly assess and correct such deviations. This monitoring and adjustment process facilitates the desired behaviors of a learning organization – one that maintains nuclear safety as its overriding priority and continuously seeks ways to improve. (Nuclear Energy Institute, 2014, p. 1)

The overall strategy is shown below.

Figure 2: Details of Nuclear Safety Culture Monitoring Process



(Nuclear Energy Institute, 2014, p. 7)

As can be seen, a process of mining the organization for safety culture relevant data from a variety of sources is recommended (the text goes into more detail on high and low yield inputs, but they vary from regulatory inspections to any trending the plant does on its many processes). These process inputs are then fed to a series of committees, with an aim to "review emergent issues and trends that could affect the health of the site nuclear safety culture, and develop a better understanding of their safety culture implications" (Nuclear Energy Institute, 2014, p. 15).

The "data collectors and analyzers" are those who comprise the safety culture monitoring panels. The NEI describes the monitoring panel meetings:

> Using the knowledge and experience of its members, the NSCMP identifies emerging themes and develops insights based on the information deemed to be most pertinent to nuclear safety culture. The panel's preparations and discussions foster a shared understanding of the health of the nuclear safety culture and what needs to be done to strengthen it. (Nuclear Energy Institute, 2014, p. 15)

The NEI suggests that the NSCMP meet at least quarterly.

The output of this meeting is fed to a Site Leadership Team. The NEI describes the SLT's function:

> Regular meetings of the Site Leadership Team (SLT) are the cornerstone of the culture monitoring process. The meeting provides the forum at which critical, reflective conversations about nuclear safety culture take

> place…the SLT should meet at least semi-annually to consider the health of nuclear safety culture at the site. (Nuclear Energy Institute, 2014, p. 10)

Many of the actions that would come from site leadership team review of the safety monitoring panel's analysis would feed into existing processes of the plant for communications and site response. Assuming that the site leadership team undertook deep, critically reflective conversations about safety culture at their organization, these actions could be different than the "typical" actions, in that they may be of longer duration and cutting to the core of safety culture as opposed to quick fixes of symptoms of decline.

5.4 Literature

The concept of monitoring safety culture has become a growing concern for the IAEA and regulators in the nuclear industry, meaning that "that there is a strong external pressure on licensees to monitor and develop the safety culture of their organisation" (Oedewald, Pia; Gotcheva, Nadezhda; Viitanen, Kaupo; Wahlström, Mikael, 2015, p. 32). This is often seen as proactive safety development, or the "continuous development of practices, monitoring of the current level of safety and maintaining a constant vigilance for weak signals" (Oedewald, Pia; Gotcheva, Nadezhda; Viitanen, Kaupo; Wahlström, Mikael, 2015, p. 19). Monitoring safety culture is also seen as "as an essential part of change. Monitoring can provide insight into the strengths and weaknesses of the existing culture and thus help guide the improvement process and measure its impact" (Viitanen, Gotcheva, & Rollenhagen, 2017, p. 11).

Lagging metrics alone are not the best way to undertake safety culture monitoring, as the link between past events and present performance is unclear (dos Santos Grecco, Vidal, Cosenza, dos Santos, & de Carvalho, 2014, p. 72), specifically accident or incident rates, despite the fact that these are typically quite accessible (Cooper, 2000, p. 124). Hence, metrics of current performance are desirable, such as"risk assessment documentation, standard operating procedures, permits to work, group discussions, etc." (Cooper, 2000, p. 124), which can be incorporated into observational checklists to be used by trained observers, to be fed back to those observed. Other metrics that could be consulted to continually monitor safety culture include "the number of completed remedial actions, risk assessments and/or the number of reported near-misses, the numbers of people receiving safety training, the number of weekly inspections completed, the number of safety audits conducted, etc." (Cooper, 2000, p. 125). Looking more at personal dosimetry, other metrics could include "the collective worker dose per annum within the organisation (or sub-section of the organisation)…the number of late and non-returned personal dose-meters" (Cole, et al., 2014, 476-477). A dashboard of metrics (both quantitative and qualitative) related to the INPO traits of a Healthy Nuclear Safety Culture was recognized as a good safety culture monitoring practice. (NAS Transportation Research Board | Special Report 321, 2016, p. 154)

However, there are other areas that monitoring can look at as well. "For example, conditions such as organisational structures, means of communication, even physical environment, affect self-organisation. By monitoring and understanding the effect of these conditions, culture could be steered in a desirable direction" (Oedewald, Pia; Gotcheva, Nadezhda; Viitanen, Kaupo; Wahlström, Mikael, 2015, p. 44). "Focusing on

other aspects of the system (such as changes to hardware, procedures and processes) may also have the benefit of improving safety culture due to the interrelated nature of the system" (Cole, Kerstan S.; Stevens-Adams, Susan M.; Weneer, Caren A.; Sandia Labs, 2013, p. 38). There may be opportunities to monitor safety culture through relationships and interactions between workers, as explained through the example of contractors at a nuclear power plant.

> From the perspective of safety culture improvement, this can include ensuring there are processes for identifying and managing such conflicts of interest that may have an effect on safety (e.g. the interest of subcontractors to gain more profit at the expense of safety or quality of the product, differing interpretations regarding how safe product should be specified, etc.), ensuring that the project leaders have sufficient understanding of the safety significance of the task at hand, and that there are monitoring systems that enable the identification of deviations from the safety-conscious execution of the task. Such targets emphasize the need for transparent and efficient interaction and bi-directional communication channels between the members of the temporary and the permanent organization, and compliance to specifications and questioning attitude from the temporary organization. (Viitanen, Gotcheva, & Rollenhagen, 2017, p. 19)

Overall, while monitoring is seen as a critical element in safety culture development, establishing credible monitoring practices that measure what counts (as opposed to what is convenient) is an ongoing challenge, but one that is worth undertaking to ensure the pulse of safety culture is constantly under surveillance.

5.5 Nuclear benchmarking

The nuclear industry spans monitoring from a regulatory obligation to an activity done exclusively by the licensees.

Belgium

The Belgian Regulatory Body (mainly Bel V) has implemented a safety culture oversight process since 2010. In a nutshell, this process is based on field observations provided by inspectors or safety analysts during any contact with a licensee (inspections, meetings, phone calls…). A "Safety Culture Coordinator" writes reports that aim at identifying early signs of safety problems and recording recurrent observations, which may result in increased surveillance of safety culture of a licensee. Yearly, a detailed report is written and the content of this yearly safety evaluation report is discussed with the licensee in order to be sure that the regulatory concerns are understood. (Bernard, Benoît; Bel V (Belgium), 2017). In Belgium, the regulatory body undertakes monitoring as a pat of regulatory oversight.

Switzerland

Switzerland has an approach that "fosters the licensees' willingness and capability to take responsibility for the safety of their installations" through "trigger[ing] self-reflection by the licensee by asking (good) questions and by applying an oversight approach (in all areas, not just safety culture or HOF)", being firm to not take over the responsibility for

safety from the licensees. (Holger, Knissel;ENSI (Switzerland), 2017). “An exchange of information with the supervised parties is required in addition to supervisory activities targeted at the assessment of observable circumstances. ENSI makes use of supervisory discussions and technical discussions for this purpose. These discussions, which take place at various managerial, specialist and technical levels, also deal with issues of relevance to the safety culture. Examples include aspects of the supervised parties’ management sys-tem, organisational or personnel changes, training of licensed and non-licensed personnel, and the operator’s programmes and activities to foster its safety culture.” (ENSI, 2016, 23-24) Hence the Swiss regulatory authority also has a direct role in ensuring its licensees monitor safety culture through its oversight.

Spain, Czech Republic, Bulgaria, Indonesia

In terms of setting expectations for monitoring, Spain has established expectations regarding the development of Human and organizational factors and safety culture programs, and has established biennial inspections related to them. (Barrientos, Marta; Gil, Benito; CSN (Spain), 2017). The Czech Republic has recently instituted an expectation for the licensees to monitor and improve safety culture, reflecting best practice (Doležal, Radim; State Office for Nuclear Safety (Czech Republic), 2017). Bulgaria also has expectations for monitoring, requiring a policy that continuously improves safety culture by an extensive process of safety reassessment (Bulgaria - contracting party report, 2016, p. 43). Indonesia also mentions monitoring as an expectation, “requirements for the licensee related to the establishment of safety policies, safety culture programmes and development….. arrangements for safety monitoring and self-assessment”. (Indonesia - contracting party report, 2016, p. 26)

In other countries, the licensees have reported having processes that continuously monitor safety culture.

Finland

A licensee “has a safety culture team that is independent from operations and construction. This team meets regularly about 10 times a year and the mission is to form a comprehensive view of the safety culture situation and report and give suggestions to the top management.” (Finland - contracting party report, 2016, p. 38)

Romania

The plant safety is assessed quarterly by the Plant Safety Oversight Committee (PSOC) by evaluating and reviewing the plant safety performance, programs, actions and indicators. The role of this committee is to maintain awareness of the plant safety issues at the plant management team level, recommendations and expectations being provided to the managers, who subsequently inform the employees in their areas of activity. (Romania- contracting party report, 2016, p. 38)

Korea and South Africa

Korea NPPs undertake yearly evaluations to monitor and “improve the safety culture continuously” (Korea - contracting party report, 2016, p. 73); similar assessments are undertaken at the South African NPPs (South Africa - contracting party report, 2016, pp. 64-65)

United States

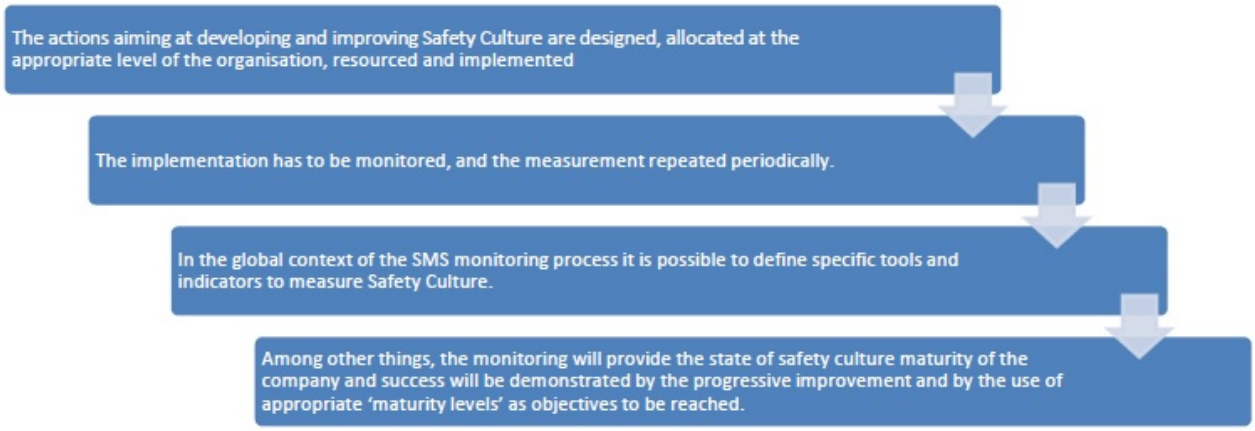
In the US, the reactor licensees have committed to monitoring their safety culture through conducting monitoring panels as described in Nuclear Energy Institute (NEI) 09-07, "Fostering a Healthy Nuclear Safety Culture," dated March 2014. (US - contracting party report, 2016, p. 120; Sieracki, Diane; NRC (United States), 2017).

5.6 Other industry benchmarking

High risk industries have an established practice to monitor safety culture. "Regular monitoring of opinions, attitudes, perceptions and behaviours of workers is common in studying the social state of the working environment" (Martyka & Lebecki, 2014, p. 563).

Specifically, aviation and air traffic control have practices that monitor safety culture. "The organisation puts significant effort into proactive measures to prevent accidents. Safety performance is actively monitored using all data available" (Piers, Michel; Montijn, Carolynne; Balk, Arjen, 2009, p. 13). It has even become a requirement, "With safety management systems (SMS) becoming a regulatory standard for aviation safety worldwide (EASA, 2009; EC/EU, 2010; International Civil Aviation Organisation, 2009), the regular assessment and continuous monitoring of safety culture turns into a prerequisite" (Heese, 2012, p. 25). Specifically, this monitoring takes place through "routine collection and analysis of data using proactive [actively seeking out hazards] as well as reactive [analysis of past outcomes/events] methodologies to monitor known safety risks and detect emerging safety issues" (Schwarz, Kallus, & Gaisbachgrabner, Safety Culture, Resilient Behavior, and Stress in Air Traffic Management, 2016, 12-13).

Rail also has expectations to monitor safety culture, " the decision to assess and improve safety culture in the organisation may also be an objective that needs to be implemented, acted upon, monitored, etc. (González, Esteban Coito; Patacchini, Anna; European Railway Agency, 2013, p. 18). This is demonstrated in a figure:



(González, Esteban Coito; Patacchini, Anna; European Railway Agency, 2013, p. 20)

The overall practice of monitoring safety culture also came out of the Lac Megantic accident learnings, as "procedures for periodic internal safety audits, reviews by

management, monitoring and evaluations of the safety management system" (Lacoursière, Dastous, & Lacoursière, 2015, p. 10) are now expected in the rail industry.

Safety culture monitoring has also been seen in marine,

> Developing monitoring practices and associated indicators for measuring safety performance and the effect of implemented decisions might help identify risk factors that remain hidden in reports focusing on assumed risks. Establishing systems with valid indicators for monitoring safety would also support a cyclical risk assessment process. (Haapasaari, Helle, Lehikoinen, Lappalainen, & Kuikka, 2015, p. 113)

Transit systems,

> Because the size of the companies interviewed varied, processes that monitor safety culture and safety performance vary as well. These processes produce both quantitative and qualitative results. … While there appears to be no single indicator sufficient for accurate measurement of the overall state of safety culture in an organization, monitoring trends in leading performance indicators as a function of time may provide insight into the strengths and weaknesses of a particular safety culture and may show the direction in which the state of safety culture is going. (NAS Transit Cooperative Research Program Report 174, 2015, p. 35;45)

And the trucking industry

> For instance, changes in driver attitudes to jobs, management, and other safety-related issues can be continuously monitored by its repeated measurement in a trucking organisation. (Li & Itoh, 2014, p. 139)

Healthcare also has reported safety culture monitoring strategies (Singer & Vogus, 2013), including leading indicators and ongoing and systematic observations (Fleming & Wentzell, Patient Safety Culture Improvement Tool: Development and Guidelines for Use, 2008). The oil and gas industry has also engaged in continuous monitoring of safety culture (Fleming & Scott, n.d., p. 49), looking not only at the practice, but focussing on the social dynamics of the enterprise.

> The focus is on the interrelationships among the components of entire systems, including workers, supervisors, equipment, training, safety procedures, work rules, and so on, with measures being used to monitor systems, track progress, and provide early warning of potentially dangerous situations…Monitoring of safety culture requires more than an assessment every 2 years through a survey. Periodic surveys and audits are most helpful when paired with other, more regular (monthly or quarterly) assessments… The intent is to keep everyone thinking about safety culture along with other management concerns, and to feed this information into the safety management system for improvement efforts… Recommendation 5.1.1: Operators and contractors should assess their safety cultures regularly as part of a safety management system. To this end, they should discuss salient inputs, even if only abbreviated data and qualitative impressions, at periodic management meetings (weekly,

> monthly, or quarterly) and as safety culture issues emerge in operations (e.g., incidents, investigations, audits, industry bulletins). (NAS Transportation Research Board | Special Report 321, 2016, 75;153-4;160)

The report also addresses the holistic nature of monitoring safety culture, "It is also leadership's responsibility to ensure the competence of the entire workforce through the hiring and training processes, the assignment of roles and responsibilities, and continual monitoring" (NAS Transportation Research Board | Special Report 321, 2016, p. 191).

Forest firefighting has undertaken monitoring for safety culture,

> A key ingredient in such evaluations is creation of a baseline of data for monitoring change as agency safety programs evolve. Such a baseline should not only include accident and incident records, but also include employee attitudes, perceptions, and behaviors toward safe work…Evaluation of the current conditions and monitoring change over time are critical to the success of any program. Evaluation enables identification of needed changes, while monitoring allows determination of whether steps taken have actually resulted in the change desired. (Lane, et al., 2014, p. 2)

As has NASA

> NASA strives to improve its Safety Culture Agency-wide. The Safety Culture Working Group develops, reviews, assesses, monitors, and tracks strategic Safety Culture activities at the Agency and Center levels to ensure long-term benefits for all NASA institutions, programs, and employees. (NASA, 2015, p. 23)

There has been advice for academic departments to establish safety culture monitoring practices, "Systems safety also makes use of safety audits and other techniques that can be used to monitor system performance and provide early detection of changes in key system parameters. (NAS Committee on Establishing and Promoting a Culture of Safety in Academic Research Laboratories, 2014, p. 23).

5.7 Summary

Continuous monitoring is a critical practice to develop and foster safety culture. While the North American nuclear industry uses principally NEI 09-07 with a fairly structured approach using the INPO traits of a Healthy Nuclear Safety Culture, approaches vary both within the nuclear industry and in other industries. Overall, monitoring safety culture is recognized to be an important activity, and part of fostering safety culture in REGDOC-2.1.2.

6. Requirement 2 – Safety Culture Assessment – General

This section deals with general issues concerning the assessment of safety culture.

6.1 REGDOC contents

> Licensees shall conduct comprehensive, systematic and rigorous safety culture assessments at least every five years.
>
> **Section 3**
>
> A safety culture assessment involves systematically gathering, reviewing and analyzing culturally relevant data, as well as identifying and implementing improvement actions. This is to promote safety, learn about organizational factors affecting safety, and to continually seek an understanding of how culture operates within the organization.
>
> Principle 2 reads "Safety culture is influenced by external and internal factors including all workers". Organizations engaged in complex work involving many interdependent workers and processes can benefit from safety culture assessments.
>
> Principle 3 reads "Safety culture is complex and changes over time." Changes in the organization can affect the safety culture – assessments should be carried out as operational needs dictate (new ownership, governance, structure, responsibilities or new activities such as refurbishment, decommissioning, etc.).
>
> A safety culture assessment provides an opportunity for organizational leaders to actively promote and foster a healthy safety culture. Their support for engaging workers in open discussions, decisions and actions on safety ensures an environment of continual safety improvement. Shared space is a critical aspect of safety culture assessments; these assessments depend on the free flow of views and opinions in an environment of trust. (CNSC, 2017, 7-8)

6.2 IAEA documents

The IAEA has many documents on safety culture – some extracts below show how the IAEA perceives assessment of safety culture in general terms. This is not meant to be a comprehensive assessment of the IAEA's literature of safety culture, as much as a sampling of some key documents.

INSAG 4

> In Section 3, Safety Culture was considered as the assembly of commendable attributes of any organization or individual contributing to nuclear plant safety. This general treatment needs extending to cover the separate attributes of different organizations. Also, examples are needed:
>
> - to show that Safety Culture is a concrete concept essential to safety;
> - to provide a basis for judging the effectiveness of Safety Culture in specific cases;
> - to identify options for improvements. (IAEA, 1991, p. 15)

INSAG 4 was the first attempt to operationalize the concept beyond the initial introduction of INSAG's introduction of the term "safety culture". Most of the document

is focused on what constitutes a “strong” safety culture, as opposed to how to know that an organization is at that state.

SRS 11

> No composite measure of safety culture exists. The multifaceted nature of culture makes it unlikely that such a measure will ever be found. Changes are usually slow and often imperceptible, but history demonstrates that cultural changes can be discerned over finite periods of time, and the same should be true of safety culture. To assess progress in the development of safety culture we may have to abandon the search for a single composite measure and concentrate on identifying the range of indicators that reflect the individual sub-components of culture. The basic range would comprise measures for observable behaviour, conscious attitudes and perceptions or beliefs. (IAEA, 1998, p. 29)

TECDOC 1329

> It is very difficult to measure change in perception or belief, particularly since many of them may be at the subconscious level. An indication that a subconscious belief may be having an important influence is the presence of a significant inconsistency between observable behaviour and conscious attitude. To measure beliefs requires psychometric techniques of an advanced nature and the interpretation of results can be difficult. Normally, behavioural observation and attitudinal surveys should provide ample information for measuring cultural change. (IAEA, 2002, p. 31)

In the above SRS and TECDOC, there is more of an appreciation of how different safety culture assessment is from other more familiar audit-type approaches. The recognition of the lack of a “single composite measure” and the specific expertise “psychometric techniques of an advanced nature”, as well as the difficulty in interpreting results reveals the challenge safety culture assessment posed.

SF-1

> The management system also has to ensure the promotion of a safety culture, the regular assessment of safety performance and the application of lessons learned from experience…A safety culture that governs the attitudes and behaviour in relation to safety of all organizations and individuals concerned must be integrated in the management system. (IAEA SF 1, 2006, p. 8)

In the foundational document Safety Fundamentals 1, the management system is seen as the vehicle through which to promote safety culture, as well as articulating that safety culture is to be integrated in the management system, so as to “govern the attitudes and behaviour” of the entire organization, not an independent programme to be managed.

GSR part 2

> Requirement 14: Measurement, assessment and improvement of leadership for safety and of safety culture Senior management shall

> regularly commission assessments of leadership for safety and of safety culture in its own organization. (IAEA GSR Pt 2, 2016, p. 17)
> 6.9. Senior management shall ensure that self-assessment of leadership for safety and of safety culture includes assessment at all organizational levels and for all functions in the organization. Senior management shall ensure that such self-assessment makes use of recognized experts in the assessment of leadership and of safety culture.
> 6.10. Senior management shall ensure that an independent assessment of leadership for safety and of safety culture is conducted for enhancement of the organizational culture for safety (i.e. the organizational culture as it relates to safety and as it fosters a strong safety culture in the organization).
> 6.11. The results of self-assessments and independent assessments of leadership for safety and of safety culture [1] shall be communicated at all levels in the organization. The results of such assessments shall be acted upon to foster and sustain a strong safety culture, to improve leadership for safety and to foster a learning attitude within the organization. (IAEA GSR Pt 2, 2016, p. 18)

As GSR Part 2 is focussed on leadership, this is the lens used to describe safety culture. Specifically the items listed include: ensuring the entire organization is within the scope of a safety culture self-assessment, ensuring the inclusion of recognized experts on leadership and safety culture, the results of an assessment are shared at all levels in the organization and that the overall goal is to enhance a culture for safety, including a learning attitude and leadership improvement.

However, with much more experience and with both practitioner and academic authors, SRS 83 has far more to offer on safety culture assessment.

6.2.1 SRS 83

> SCSAs are not a straightforward assessment of safety performance indicators against targets nor an assessment of the effectiveness of human performance programmes. Nor are they quantitative in a way that permits construction of a performance index. Furthermore, a traditional audit or assessment mindset may inhibit the gathering of information from participants and increase defensiveness. Safety culture assessments have distinct attributes compared with typical assessments or audits:
> a) Specialized training is needed to observe and interpret cultural influences, since linear, cause–effect approaches do not apply. SCSAs involve theoretical frameworks and multilevel, multivariate analyses that are unfamiliar to most nuclear power plant staff. Inquiry is exploratory and requires applied insight into human and organizational behaviour.
> b) The approach involves a learning journey rather than a checklist against expectations.
> c) Success requires that the process be experienced by the organization as a constructive one that translates into personal and team learning. This builds receptivity to the process over time. SCSAs are part of a larger

systemic learning–development–improvement cycle, rather than inputs to a corrective action process.

d) A significant purpose of safety culture assessments is to capture information that helps to foster dialogue, reflection and insight within the organization regarding its behaviour.
e) Safety culture assessments explore the dynamics of the informal and formal organization as well as thought systems, sense making, and personal perceptual biases or action logics that reflect common patterns of comprehension and response in the organization.
f) Safety culture assessments help to reveal the complex interplay of multicultural dimensions of the organization. They seek to capture issues that manifest in daily activities in an almost unconscious fashion, and where understanding of the impact needs to be fed back into the whole fabric of the organization.
g) Safety culture assessments provide clarity on the organizational effectiveness and its contribution to safety.
h) Safety culture assessments give organizations an opportunity to be proactive about reducing latent systemic risks. (IAEA SRS 83, 2016, pp. 15-16)

Aside from the reiterated messages of specialized expertise and being fundamentally different than audit approaches, this safety culture assessment list includes team development, a learning journey, as well as a preventive approach addressing latent system risks. It focusses on interpersonal and organizational dynamics, common patterns of perception and response and systemic learning.

> Culture is often an unplanned product of long term growth processes. It is impossible to control such processes totally, but through the careful application of SCSAs, it is possible to comprehend and influence culture. SCSAs play a key role in developing and maintaining an awareness of strengths and opportunities for improvement, as well as how and why the organization, or parts of the organization, acts in a certain manner. (IAEA SRS 83, 2016, 16-17)

This talks of the overall importance of safety culture self-assessments (SCSAs) as they not only allow understanding the culture, they can maintain an awareness of the importance of the culture throughout the organization. SRS 83 also talks about a concept of “shared space”, which is a critical aspect to safety culture assessments.

> The impact of an organization’s culture on its safety performance comes down to the nature of interactions between individuals, departments and hierarchies, as well as relations with external organizations. The quality of these interactions determines how people collectively engage, share information and integrate efforts to consistently make safety the top priority. The IAEA is introducing the concept of shared space as means for enhancing the quality of interaction to support mindfulness, engagement and well-being (see Fig. 5)… Trust is a characteristic that emerges through human interactions, hence promoting healthy and frequent interactions is important in making change. In this regard, the

> concept of shared space is critical to effective human interaction. Shared space involves the creation of working relationships that help to build shared meaning through an open, free flowing sharing of thoughts and ideas. Shared space goes deeper than sharing facts and exchanging information in a professional, respectful manner. It enables individuals to express views related to their inner thoughts and feelings about a particular issue without fear of recrimination or exclusion. In the absence of shared space, there is a risk that individuals will only contribute the minimum necessary to 'stay out of trouble'. (IAEA SRS 83, 2016, p. 12)

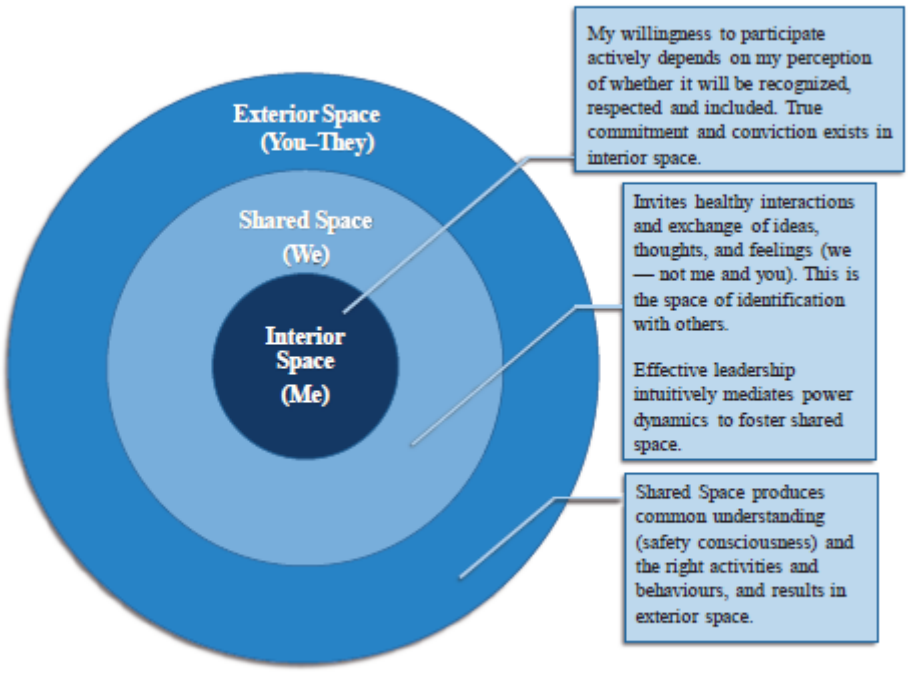


FIG. 5. Motivational elements related to the creation of shared space.

(IAEA SRS 83, 2016, p. 13)

As can be seen, shared space depends on meaningful interactions, truthful engagement and an overall safe environment to share views and perceptions. While this could be an unfamiliar, uncomfortable environment, it is key to a successful safety culture assessment. This can help foster a healthy safety culture whereby "… employees are fully engaged, meaning that they are emotionally and mentally present and committed to the work environment and engagement with others, … several norms important to safety are more likely to be present" (IAEA SRS 83, 2016, p. 13).

Getting more into the specifics of assessing,

> This section addresses the application of methods that are useful for the conduct of SCSAs. In Appendices III–VII, more guidance is provided on how to use the safety culture assessment methods. The methods discussed are document reviews, questionnaires, observations, focus groups and

> interviews. These methods are recognized and used by researchers, safety culture experts and organizations working with safety culture assessments [1, 9–12]. See the Annex for a theoretical framework. It is essential to use multiple methods. Each method provides different information and engages the organization in a different way. Assessors are to be assigned based on their suitability and interest in applying a particular method. It is advisable that each assessor tries all types of method. In each case, the method is to be set up and administered in a manner that provides a positive experience, engages participants and fosters learning. During the application of methods, it is important to avoid jumping to premature conclusions based on the use of one method. For this reason, it is important to apply and analyse the results from each method independently and in a descriptive manner. (IAEA SRS 83, 2016, p. 30)

This extract highlights a) the extensive literature underlying safety culture assessment methods b) the importance of multiple methods c) assessor use of the methods d) independent descriptive analysis of results of each method.

> To maximize the learning from the self-assessment, it is essential to engage all levels of the organization. Static methods, such as document reviews and questionnaires, need to be supplemented by the use of interactive methods. The selection of approaches has an impact on the organization's perception of the degree of inclusion and comprehensiveness of the assessment. Safety culture assessments do not need to be a time limited, pressured exercise, and are often more accepted by the organization as an ongoing activity that takes snapshots supplemented by more comprehensive periodic assessments, typically at intervals of 2–3 years. (IAEA SRS 83, 2016, p. 31)

This paragraph again reinforces the multiple methods approach, but also speaks of their selection having an influence on the overall assessment. Consistent with the journey approach, the extract suggests that safety culture assessments need not be seen as a "time limited pressured exercise", but an ongoing activity that are supplemented by "comprehensive periodic assessments".

> The results of an interpretive study are always subject to interpreter bias. Having a well-functioning team with a reflective mindset is important to balance for this, but the interpretation will always be just an interpretation and not a final truth. The results of the self-assessment need thus to be treated as an input to further organizational development processes, not as a template of fixes to force onto the organization. Ideally, the results of an SCSA serve as an eye-opener that starts a process of reflection and learning in the organization, facilitating new ways of asking questions about how and why the organization's members act and think the way they do. No single interpreter has the right to define what the culture is. Instead, recipients have an obligation to reflect on what the interpretation means for them. (IAEA SRS 83, 2016, p. 45)

This speaks of the analysis of the data, and that the goal is an “eye opening” process as opposed to a search for the “final truth”. “The results of the self-assessment need thus to be treated as an input to further organizational development processes, not as a template of fixes to force onto the organization” is particularly illustrative. The entire approach is one of “reflection and learning”, encouraging people to see their daily work from different viewpoints, to enrich the understanding of why and how work is accomplished in the organization.

6.3 Literature

Safety culture research has often assumed a single approach for the entire organization, although this is not consistent with the origins of cultural research.

> Research on culture in general and organisational culture in particular has been of interest not only to social, personnel and organisational psychologists but also to sociologists, anthropologists and political scientists. The main emphasis here, however, is on applied research in the social psychological or organisational psychological traditions. One important assumption associated with these traditions is that a large group of organisational cultures can be described with a limited number of dimensions. Such dimensions are usually sought through large, organisation-wide questionnaire surveys with the ultimate purpose of description or diagnosis and - possibly - intervention. It is acknowledged that this is not the whole story, though. (Guldenmund F. W., 2000, p. 216)

How one assesses will depend upon their professional orientation, and how they see safety

> Moreover, it is of major significance whether one considers organisational culture a collection of - observable - practices (e.g. Hofstede, 1991), a finite set of - conscious – attitudes (e.g. Jones and James, 1979) or a small amount of - unconscious – basic assumptions (e.g. Schein, 1992). Clearly, such diverging views will result in different research questions, paradigms, methods and outcomes. (Guldenmund F. W., 2000, p. 226)

Another crucial consideration for safety culture assessments is confidentiality, as the sensitive nature of the content of a safety culture assessment should not be attributable to individuals. This does affect reporting of results.

> Due to the sensitive nature of these data and the implications that may have for both the organizations involved, and our subsequent working relationships with those organizations, we opt to withhold reporting the specific nationalities involved. To report information on nationalities would compromise the anonymity of the ANSPs(Air Navigation Service Provider) because there are several nations with only one ANSP. (Tear, Reader, Shorrock, & Kirwan, 2016, p. 1623)

And the nuclear industry needs to adapt safety culture assessments for lifecycle approaches.

> The safety science community has developed various means for analysing and developing a safety culture and organisational activities for proactive purposes, but it may be that these methods are not optimally integrated into the management practices of the nuclear industry. There is a need for research in the interface of the safety culture theories and the practical management approaches. It may also be that safety culture approaches and safety management practices need to be further developed in order to support a transformation from too strong a focus on "culture of control" towards resilient organisations. Furthermore, the safety culture challenges at the various lifecycle stages, which involve multiple subcontractors, should be better understood, in order to be able to improve the practices for managing safety in those activities. (Oedewald & Gotcheva, 2015, p. 7)

Overall, without getting into too far into the specifics of various methods, there are many caveats concerning measurement of safety culture, from an overreliance on quantitative data, aggregation, confidentiality and consistent with a life cycle.

6.4 Nuclear benchmarking

Belgium, Spain

A Belgian report comments on safety culture assessments

> We can say that Safety Culture is not immediately visible but could be observed everywhere and everytime! As an underlying and prevailing framework, SC shapes in a stable way how people perceive a situation, make sense of it and act. In other words, observing SC outcomes implies to adopt a global (or holistic) point of view: facts or statements drawn out during specific interactions with licensees (meetings, inspections, assessments, walk-down, informal contacts…) are part of a broader human system. Considering the individual, group and organisational levels, an observation must then be a tool matching artefacts with deeper cultural layers. (FANC/AFCN & Bel V, 2013, p. 3)

Furthermore, the Belgian regulator evaluates the assessment methodology of the licensee, as well as corrective actions, and compares the licensee results with the regulator's assessment results (Bernard, Benoît; Bel V (Belgium), 2017). Spain also conducts biennial inspections on safety culture related topics (Barrientos, Marta; Gil, Benito; CSN (Spain), 2017)

Switzerland

Switzerland takes a guiding approach, not a firm regulatory one.

> We think that an important role of the regulatory body is to trigger self-reflection by the licensee by asking (good) questions and by applying an oversight approach (in all areas, not just safety culture or HOF) that fosters the licensees' willingness and capability to take responsibility for the safety of their installations. I.e. we shall avoid taking over the licensees' responsibility. We have formulated a guiding principle in our Mission Statement (https://www.ensi.ch/en/documents/mission-statement-

> ensi/) in line with this thinking: “Through our supervision, we strengthen the safety culture of the supervised parties, and we encourage them to take responsibility for their own actions”. (Holger, Knissel;ENSI (Switzerland), 2017)

Argentina

Argentina views safety culture holistically, involving many areas of the plants.

> In 2011 NASA (licensee) developed a Program for the Strengthening of the Safety Culture. This program is devoted to the NPPs, as well as to other groups and activities associated to them. It not only covers nuclear safety but also radiological safety and the industrial safety, including fire, environmental protection and emergencies. The activities timetable covers three years (Argentina - contracting party report, 2016, p. Q 38)

Czech Republic, US

Neither the Czech Republic nor the US require routine safety culture assessments, but can review the licensee assessments as part of their oversight. The US plants have committed to undertaking safety culture self-assessments every two years (Doležal, Radim; State Office for Nuclear Safety (Czech Republic), 2017; Sieracki, Diane; NRC (United States), 2017).

Indonesia

While there are no power plants in Indonesia, the expectation of safety culture assessments exists.

> These regulations set the basis and requirements for the licensee related to the establishment of safety policies, safety culture programmes and development, arrangements for safety management, arrangements for safety monitoring and self-assessment, independent safety assessments, discussion on measures to improve safety culture, a process oriented (quality) management system, as described in more detail below. (Indonesia - contracting party report, 2016, p. 26)

6.5 Other industry benchmarking

Overall assessment philosophies in the transportation industry highlighted the same methods issues of safety culture assessments as in the literature.

> Safety climate studies generally use formal quantitative methods, while safety culture studies historically have used mainly qualitative case study techniques. However, the number of safety culture quantitative studies is increasing...This mutual reinforcement confirms the value of combining different methodological approaches in social science research, particularly the value of combining quantitative and qualitative methodologies to address related questions from different perspectives. Social science researchers have long held the consensus that this type of “integration leads to maximizing the strengths of the quantitative and qualitative data and minimizing their weaknesses” (Creswell et al., 2011). (NAS Transit Cooperative Research Program Report 174, 2015, 16, 24)

This report also found the association of positive safety climate and culture scores with improved safety performance (NAS Transit Cooperative Research Program Report 174, 2015, p. 16)**.**

The methodological considerations are also seen in healthcare

> The difference between culture and climate is often reduced to a difference in methodology. Studies involving surveys of clinicians and staff are categorized as studies of safety climate, and ethnographic studies involving detailed, longitudinal observations are categorized as studies of safety culture. The terms are often used interchangeably in practice, but it is important to remember that there are conceptually meaningful differences in their scope and depth. For the purpose of this review, studies of both patient safety culture and climate were included. We use the term patient safety culture in discussion only to simplify the reporting of results. (Weaver, et al., 2013, 2-3)

Oil and gas have an understanding of safety culture assessments being the organization's responsibility

> Therefore, the long term goal should be to bring the organization's self-assessment and self-reflection capabilities as close to the work as possible, involving everyone in the safety culture assessment process. Internalizing the capability for gathering and analyzing data on safety culture is especially important in the offshore industry because offshore organizations vary greatly in size, resources, risks, and sophistication, so it is necessary to tailor safety culture assessment to each organization. (NAS Transportation Research Board | Special Report 321, 2016, p. 155)

And academia is learning from other fields' experience with safety culture assessments

> In particular, could the ideas and methodologies of safety culture from the industrial sector, including non-laboratory settings such as the airline industry, health care, and manufacturing, be brought in a more intentioned way to produce recommendations for making laboratory science safer? (NAS Committee on Establishing and Promoting a Culture of Safety in Academic Research Laboratories, 2014, p. ix)

6.6 Summary

The overall general safety culture assessment review reveals that the way to assess the Schein model of safety culture is to use multiple methods, and to not over rely on quantitative data. This is appreciated in the literature, in other domains, and at the IAEA. The assessment process is not straightforward, and is often more of a journey of self-reflection rather than an arduous procedure that is periodically undertaken. This overall general approach is consistent with that proposed in REGDOC-2.1.2.

7. Requirement 2 – Safety Culture Assessment – Methods

This section covers the "how to" assess safety culture – specifically, the process and the data collection methods.

7.1 REGDOC contents

Licensees shall conduct comprehensive, systematic and rigorous safety culture assessments at least every five years

Section 3.1

Adhering to a set of criteria ensures that safety culture assessments are consistent and subsequent findings are reliable over time. The following criteria apply to safety culture assessment approaches (the overall means) and methods (the specific data collection and analysis tools). Although these are intended for assessments conducted in large organizations, any size or type of licensee may use them to develop, improve and refine safety culture assessments.

Comprehensive

- The assessment approach is used to assess the entire organization, or a range of different job positions, departments, demographics and lines of work.
- The assessment approach covers the range of cultural characteristics/traits being assessed.
- The assessment approach uses a combination of quantitative and qualitative methods in order to build a comprehensive understanding of the licensee's safety culture.

Systematic

- What is to be assessed is clearly described.
- Methods measure what they claim to measure.
- Information obtained from an assessment method is clearly recorded to allow traceability throughout the analysis.
- The assessment produces a clear interpretation of the organization's safety culture, based on collected data.
- Actions resulting from the assessment are linked to the analysis and the collected data.

Rigorous

- The methods control for bias and unwanted subjectivity throughout the stages of scope setting, training, data collection, analysis, review and reporting.

- The methods and subsequent analyses are defensible and are described in sufficient detail to be replicable by different individuals and across time.
- The assessment approach yields information that is credible because it is based on collected data. (CNSC, 2017, p. 8)

The process of how to undertake an assessment is also described throughout section 3; the headings of each section are:

3.2 Preparing for the safety culture assessment
3.3 Plan the assessment
3.3.1 Assessment team selection
3.3.2 Internal communications strategy
3.3.3 Assessment framework
3.3.4 Assessment method selection
3.4 Data collection
3.5 Data analysis
3.6 Assessment report
3.7 Respond to the assessment and transition to action (CNSC, 2017, p. iii)

These sections are based heavily in SRS 83, although not every aspect of these sections will be covered in this review.

7.2 IAEA Documents

TECDOC 1329

This TECDOC was written after the INSAG volumes that specified the framework (the "what" of safety culture), and provided a near step-by-step how-to guide on performing safety culture assessments. Below is a significant extract of assessing using the Schein model.

> 6.1. USING THE THREE LEVEL MODEL
> Schein's Three Level model is a useful way to develop an understanding of safety culture in an organization. Recall that the model is based on three levels of culture: artefacts which are visible; espoused values which can be determined; and basic assumptions which are tacit and out of awareness. The best way to use the model is to assemble a group comprising representatives from the key areas of the organization. This may be the group that ultimately will be involved in the project to assess the safety culture. If this is the case, the individuals in the group should have the appropriate skills, for example, at least one person should be familiar with statistics, and also there should be a person having some knowledge of psychology. Having formed the group, the next steps are outlined below.
>
> **6.1.1. Identify artefacts**
> Start by identifying many of the artefacts that characterize the organization. Ask people to recall what they noticed when they first joined the organization, and whether what they noticed is still present. Write down all the items that are identified. The following list can serve as a

prompt to make sure that you cover all the areas in which cultural artefacts are visible:
(1) Dress code;
(2) Level of formality in authority relationships;
(3) Working hours;
(4) Meetings (how often, how run, timing);
(5) How decisions are made;
(6) Communications: how are people informed;
(7) Jargon, uniforms, identity symbols;
(8) Ceremonies and rituals;
(9) Disagreement and conflict: how handled;
(10) Policies and procedures;
(11) Plans: what do they cover;
(12) Visibility of senior managers.
Do not restrict the identification of artefacts at this stage to safety-related artefacts, although you may wish to place an asterisk against any in this category to facilitate later identification.

6.1.2. Identify espoused values

Ask the group to identify some of the espoused values that the organization holds. Some may already have been mentioned when identifying artefacts. When this happens, list them under espoused values. Espoused values are often stated in formal documents such as strategic plans where they may be included when vision and mission statements are given. Again at this stage do not restrict contributions to safety-related espoused values, but you can highlight any that are in this category.

6.1.3. Compare espoused values with artefacts

Identify how the espoused values may be linked to the various artefacts that have been listed. For example, teamwork may be an espoused value, but at the artefact level the reward system is based on competition between individuals. When there is an inconsistency between what is observed at the artefact level and espoused values, you have probably identified an area where a deeper tacit assumption is operating. You now have to search for that deeper assumption. By identifying the inconsistencies and conflicts between overt behaviour, policies, rules, practices and the espoused values, you will gradually identify the deeper levels of the organizational culture. You may begin to see patterns among the basic assumptions that are driving the system, and which explain the presence of most of the artefacts that you have listed. If you think that there may be cultural sub-groups that have their own basic assumptions, you can test this by forming groups that will reflect possible differences.

6.1.4. Eliciting the basic assumptions

Assess the pattern of basic assumptions that you have identified in terms of how they help or hinder you in accomplishing safety goals. Since culture is very difficult to change, concentrate on identifying the assumptions that can help you. Try to see your culture as a positive force to be used rather than a constraint to be overcome. If you identify

particular assumptions that you consider to be real constraints on improving safety, note them as requiring future action to change these elements of culture. The above four-part exercise will provide useful data on the overall organizational culture and the influence of that culture on safety. The exercise is best conducted with the assistance of a facilitator who understands the concept of culture, and who is not a member of the organization that is undertaking the cultural self-assessment.

6.2. LINKING ARTEFACTS, ESPOUSED VALUES AND BASIC ASSUMPTIONS TO SAFETY CULTURE CHARACTERISTICS

In an organization in which safety is central to the culture, we have already identified some of the artefacts, espoused values and basic assumptions associated with safety. We shall now try to link each of the component levels of culture with the safety culture characteristics. To do this, take each safety culture characteristic in turn, and identify the particular artefacts, espoused values and basic assumptions that are relevant to the that characteristic. Some artefacts, espoused values and basic assumptions will be associated with more than one safety culture characteristic. An example will illustrate what is required.

Characteristic: *involvement of all employees*

Artefacts:

- Safety improvement teams
- Employee involvement in safety inspections
- Surveys of employee safety attitudes
- Employees contribute to safety plans

Espoused values:

- Teamwork
- Everybody is responsible for safety
- Empowerment of people

Basic assumptions:

- People have a right to be involved in activities that affect their lives
- People will contribute positively if given the opportunity
- People can be trusted to do what is right

This above list is not comprehensive and could be expanded. The benefit of the exercise is twofold: firstly, it demonstrates that safety culture is embedded in the organizational culture as you are able to show the link between the individual safety culture characteristics and the artefacts, espoused values and basic assumptions of the organizational culture; secondly, it identifies the safety culture characteristics that may be missing in that no artefacts can be found that reflect the characteristic's presence. This information is useful when considering future improvements to the safety culture of the organization. (IAEA, 2002, 32-34)

This advice does not go into the mechanics of data collection, as much as the approach to assess collected data. It helps with a suggested list of artefacts, and progresses to eliciting basic assumptions (which are only surmised through analysis).

GSR part 2

> 4.24. Competences to be sustained in-house by the organization shall include: competences for leadership at all management levels; competences for fostering and sustaining a strong safety culture; and expertise to understand technical, human and organizational aspects relating to the facility or the activity in order to ensure safety. (IAEA GSR Pt 2, 2016, p. 13)

GSR Part 2, while not having specifics on how to undertake a safety culture assessment, does outline the competencies necessary to do so, from leadership at all levels to those with the expertise in areas of safety culture.

7.2.1 SRS 83

SRS 83 devotes considerable attention to the mechanics of carrying out a safety culture assessment. This is in two main parts – the process, or the steps that are taken to undertake an assessment, followed by the data collection methods. It then addresses the analysis in broad terms. All the sections have additional information in the appendix of SRS 83; only the text is extracted below.

Process

> The self-assessment process follows the general steps given in Fig. 6. The following summarizes each of the steps. Details are provided in subsequent sections of this Safety Report and more practical guidance is to be found in Appendices I–IX. (IAEA SRS 83, 2016, p. 21)

FIG. 6. Safety culture self-assessment process.

(IAEA SRS 83, 2016, p. 22)

Step 1: Prepare the organization

For a safety culture assessment to be effective, senior management needs to be significantly engaged throughout the process rather than delegate responsibility. Senior management is advised to form a partnership with the organization's self-assessment team to bring visible commitment to the initiative. A workshop or seminar with senior management is an effective way to ensure alignment and:

- To confirm the scope of the assessment (e.g. corporate organization, headquarters, vendors, contractors, technical support organizations, timeframe and potential interferences), resources and organizational effort, and desired impact;
- To identify a self-assessment team including champions and participants from different levels and functions, and to choose team members according to the competencies needed to make the team successful (e.g. interpersonal and communication skills, and pattern recognition);

- To commit sufficient time and resources to allow the self-assessment team to conduct the assessment, and to allocate sufficient management time to participate in the initiative;
- To engage organized labour (unions) during this and subsequent steps of the process to ensure they are fully aware of the purpose and approach;
- To develop a strategy to address the results of the assessment, including responding to, and working with, areas in need of improvement;
- To prepare a communication strategy to inform personnel of the upcoming assessment and intent, and to emphasize the importance of active participation. It is important to position the safety culture assessment as a learning opportunity to identify what is working well, and what could be done differently to enhance safety performance.

Step 2: Prepare the self-assessment team

The self-assessment team orientation and training should be based on needs. It is important to train team members to ensure they are proficient in the assessment methodology and its methods to capture data as well as the approach of the analyses. This requires suitable behavioural, social sciences and organizational psychology resources to support the assessment process, either internally, through contracts or through support from organizations such as the IAEA. For the first several assessments, including independent assessors can reduce bias. Activities in this step include:

- Training the team members;
- Clarifying roles and responsibilities (see Sections 4.4 and 4.5) and team protocols;
- Identifying the assessment strategy and methods;
- Preparing the methods to be used, ensuring that the methods are applied as independently as practicable;
- Conducting a bridging seminar between senior management and the assessment team to clarify expectations of the respective teams and ensure alignment.

Step 3: Prepare the self-assessment plan

The assessment plan should cover activities from the pre-launch to the communication and follow-up of the results. The logistics of implementation and any concurrent plant activities to minimize organizational impact are to be considered.

According to the IAEA safety standards, several methods are needed for the assessment in order to capture an accurate and comprehensive image of the culture. Nevertheless, after having performed several assessments periodically, the methods used could be altered, not using all methods for each assessment (see also Section 4.1, regarding capacity and scope of self-assessment). When selecting methods, consideration should be given to the fact that some methods are more interactive and provide richer data and impressions. Methods include:

- Non-interactive methods: Document reviews, questionnaire and observations;
- Interactive methods: Focus groups and interviews.
- Planning to apply the methods in parallel and independently to provide multiple sources of information around the same topics of interest minimizes the risk of biasing the assessment approach. Additional activities include:
- Testing the assessment infrastructure (e.g. questionnaire administration methods);
- Planning the communication and change approach;
- Conducting a pre-job brief for the assessment team before launching the assessment.

Step 4: Conduct the pre-launch

- The activities in step 4 are:
- To orient the organization to the purpose of the assessment and the detailed execution plan through a variety of communication channels;
- To use senior managers to assist in promoting the assessment;
- To stress that the assessment is not an audit but a method of engaging the organization to learn about its existing attitudes and behaviour and their influence on safety.

Step 5: Conduct the self-assessment

The activities in step 5 are:

- To capture information as facts provided by the organization without interpretation or judgement;
- To maintain records throughout the process to assist in the interpretation phase;
- To not select topics or data based on personal biases;
- To ensure organizational access to information regarding the progress of the assessment;
- To respond to any questions.
  In cases where observations indicate the need for prompt intervention because of a potential to create unsafe conditions, the issue is to be brought to the immediate attention of the parties involved, including the management and the assessment team lead.

Step 6: Analyse the results

Analysis is a two step process: a descriptive analysis followed by a normative analysis. The first step involves analysing the results from the individual methods and:

- Interpreting the results for each method independently;
- Looking for relationships and patterns as well as elements that do not appear to be consistent;
- Analysing the combined results to identify overarching themes after analysing the results for each method;
- Looking for relationships, patterns and elements that do not align across the methods;
- Determining whether more information is to be gathered.

The second step involves comparing the cultural findings in relation to a normative framework for safety culture (e.g. IAEA safety culture characteristics and attributes). This second step results in identifying the safety culture strengths and areas in need of improvement.

Step 7: Summarize the findings

The activities in step 7 are:

- To organize the information in a way that best suits the communication and learning style of the organization;
- To develop key messages to help the organization to influence behaviour that needs to be reinforced, changed, added or extinguished;
- To develop communication packages that suit the various target audiences.

  Typically, the results are summarized in a report prepared by the team lead with input from all team members.

Step 8: Communicate the findings

The activities in step 8 are:

- To communicate the findings formally to management, encouraging open dialogue regarding the potential impact of the results;

Step 9: Develop and implement actions

To communicate with the rest of the organization through various channels, such as dialogue forums with groups, posting the results on a commonly utilized and accepted platform such as the intranet. In addition, communication methods that encourage interaction and dialogues are preferable to one way reporting because they support reflection and shared understanding of revealed cultural dimensions. This is of key importance for organizational learning. (IAEA SRS 83, 2016, 21-26)

There is more guidance offered before the assessment begins in terms of organizational readiness “In undertaking an SCSA, there are several considerations related to the organization’s level of readiness for performing an assessment” (IAEA SRS 83, 2016, p. 19) and application of shared space in safety culture assessments “A well functioning shared space…is critical to the success of any safety culture assessment to build trust and an open climate to ensure all team members contribute” (IAEA SRS 83, 2016, p. 20).

After the assessment, more guidance is given on capturing lessons learned “Lessons learned and improvements to the self-assessment process can be captured at any time during and after the process” (IAEA GSR Pt 2, 2016, p. 26) and conducting a follow-up “Conduct a follow-up within 6–18 months of the assessment to confirm the progress and effectiveness of the activities in the action plan” (IAEA SRS 83, 2016, p. 26).

Methods

This section of SRS 83 walks through the five suggested data collection methods – document review, questionnaires, observations, focus groups and interviews – each with a description of the method, the applicability of the method, and some caveats to be aware of with that method. These descriptions are brief synopses of vast amounts of social science research in each of these areas, and the reader is invited to read further in the appendices.

5.2. DOCUMENT REVIEW

Document reviews can be performed in advance of the actual self-assessment. They familiarize assessors with the full breadth of the organization's documentation, since this may not be familiar to assessors from specific departments. They also familiarize assessors with the language and terminology of various groups.

Document reviews reveal how an organization represents itself in writing, and what the organization's members shared values and basic assumption consist of. For example, historical performance data, policies, event investigation, organization structure scheme and procedures all provide a rich source of cultural information and insight into basic assumptions by showing common reasoning patterns. They reveal the adequacy of guidance and rigour in important safety areas.

5.2.1. Working with document reviews

The aim of a document review is to gather information on how the organization thinks and intends to behave. Document reviews can provide insight into how an organization prioritizes safety through its management system documentation, and how it intends its policies, programmes and processes to work in practice. Typically, documentation reveals approaches and beliefs related to ensuring compliance, including how positional power or authority is distributed in the organization and the degree of formality or informality of safety controls. Similarly, safety indicators and reports on compliance with requirements provide insight into safety performance and corrective action patterns. The extent and nature of documentation can show how the organization approaches and promotes connectivity or systemic views and prioritizes aspects such as accessibility and user friendliness of documentation to guide member actions. Document reviews can also give the basis for determining at a later stage whether people know of the existence of written guidance and use it.

Document reviews provide the basis for insight into differences between stated intent and actual behaviour. For example, the organization may adapt industry approaches to their situation or simply copy from others with little modification, thereby failing to fully integrate the approach into the organization's way of doing work. Document reviews can reveal how review and approval processes work, which may indicate latent organizational challenges such as upward delegation.

Document reviews frequently provide a means of understanding how organizational learning (e.g. from experience feedback, events and assessments) is translated into captured knowledge and guidance.

5.2.2. Limitations and risks

Document reviews are labour intensive. They require assessors to identify relevant information and patterns of thinking from within the large number of documents typical of nuclear facilities. In addition, they may not reflect the true internal thinking, understanding or action of the organization if they were created primarily in response to stakeholder requirements.

Appendix III provides additional information on performing document reviews.

5.3. QUESTIONNAIRES

Questionnaires provide a convenient way to obtain input from a large number of people. Computerization allows quick turnaround of data. Questions are consistent for all participants, and everyone has an equal opportunity to provide anonymous input. Questionnaires send a message that management values everyone's views. It is, however, difficult to develop a valid and reliable questionnaire. For this reason, organizations should use a professionally developed and validated instrument, such as the IAEA Safety Culture Perception Questionnaire, or seek relevant expertise if a decision has been made to develop a targeted questionnaire. External organizations such as the IAEA can also provide helpful assistance in managing the questionnaire and provide statistical analyses.

5.3.1. Working with questionnaires

Questionnaires gather information on peoples' perceptions, values, beliefs and attitudes related to the organization and its culture. They give employees a voice in expressing their views, and because they quantify perceptual information, they can be used to compare responses between groups and levels of the organization to determine the degree of cultural alignment. Questionnaires are useful in the self-assessment process because they serve to establish a baseline for tracking changes over time. They enable large scale reflection on topics of interest, and because they provide visual representations of large group findings, can help to focus discussions on issues, concerns and directions.

5.3.2. Limitations and issues

Questionnaires have several limitations. Numerical analysis may create a belief that the results are more precise or valid than may be true. Symptoms rather than underlying causes may be identified. Interpretation is vulnerable to the statistical expertise of those administering the instrument, and low response rates (less than 70%) can further compromise validity. A poorly developed questionnaire can result in erroneous conclusions or interpretations, and be too ambiguous to support improvement efforts. Appendix IV provides additional guidance on questionnaires.

5.4. OBSERVATIONS

Observations may be used on a continuing basis, not just during SCSAs. Hence, developing good observation skills is valuable for the whole organization. Cultural observations are different from task observations normally conducted at nuclear facilities. The latter are based on normative standards or comparisons with expectations, whereas cultural observations are descriptive.

5.4.1. Working with observations

The aim of conducting observations is to reveal actual performance and behaviour in real time. Observations can serve to make the meaning or importance of relationships, symbols and other artefacts visible. They readily provide an indication of the work environment and field support systems, including the state of work areas when people have left. Observations provide information about people in their actual work contexts such as how people interact, work practices and what people pay attention to in their everyday work.

5.4.2. Limitations and risks

The greatest risk to observations is the tendency to overgeneralize from a small number of findings or to examine individual behaviour instead of underlying cultural indicators. Observations require training and experience, otherwise many items are likely to be missed or otherwise misinterpreted owing to the specialist blinder effect (i.e. a natural tendency to focus on one's own area of expertise). Internal observers are influenced by local norms when observing without an external comparator or observer. Observations are subject to the observer effect, whereby people behave differently when observed. Finally, it can be difficult to guarantee anonymity of the information gathered when observing. Appendix V provides additional guidance on observations.

5.5. FOCUS GROUPS

Focus groups are useful in a variety of situations and may be used at any stage of a self-assessment process. They are often effective when used early in the process for the purpose of raising awareness, engaging people, initiating organizational conversations and fostering learning. Focus groups are flexible in the way information can be explored, for example facts, stories, opinion, experience, feelings, behaviours, values and concerns. They engage more people, which allows broader conversation. They may reveal issues and responses that are not easily accessible through quantitative methods, such as questionnaires. The interactive, open-ended nature creates learning opportunities for participants, including increased awareness beyond the primary purpose of the focus group itself, through discussion with peers.

5.5.1. Working with focus groups

The aim of focus groups is to explore a theme in an open-ended, interactive fashion. They provide an easy forum for directly observing the influence of group dynamics and power dynamics within an organization, particularly with participants from different levels and departments. Focus groups can help to raise awareness and to engage people in conversations of great importance to the organization. They can also allow a deeper exploration of issues or themes surfaced through other information gathering methods.

Focus groups can be helpful in deepening and broadening the organizational understanding of safety culture concepts, organizational behaviour and other aspects of interpersonal and organizational

effectiveness. They are particularly useful for gathering feedback and insights on specific themes, and providing a creative environment in which to generate ideas on how to improve or do things differently.

5.5.2. Limitations and risks

The challenges with focus groups primarily relate to the need for skilled facilitators to manage the dynamics, especially if the topic is sensitive or controversial. Power relationships may distort the discussion, although such interactions still provide insight into organizational dynamics. The group or individuals may also air personal agendas or vent anger or frustration. Groupthink or peer pressure can inhibit authentic participation.

When sessions are conducted by familiar colleagues, participants may be influenced by factors such as perceived trustworthiness, reputation, credibility, dominance and positional power. Focus groups are susceptible to the biases of individual facilitators or dominant participants. As with all data collection methodologies, it can be difficult to collect and interpret the information in a meaningful, valid way. Appendix VI provides additional guidance on focus groups.

5.6. INTERVIEWS

Interviews are an important method for cultural assessment. When using interviews, care needs to be taken to ensure that the interviewer is proficient with the cultural application of the method and does not unduly influence the responses. Interviewees are sensitive to the behaviour of the interviewer. For this reason, two kinds of interviews are preferred for culture assessment: semi-structured and unstructured.

In semi-structured interviews, the purpose is to gather contextual information about the organization, such as how it functions, key participants, system overviews, roles and responsibilities. The interviewer uses general questions to gather information on specific topics, for example: “Can you explain how operational safety decisions are made?”

In unstructured interviews, the interviewer minimizes interference in the dialogue by posing few, and very open, questions, allowing the interviewee to steer the interview. The focus is on gaining a deeper understanding of how the interviewee thinks, what safety concepts are prioritized, what the person is passionate about, and what tends to be ignored or avoided.

Interviews provide a high degree of interaction, with opportunities for participants to introduce issues and themes. They allow interviewers to explain context to ensure that responses address the intent of the question. The format is adaptable (e.g. individual or small group, structured or unstructured) and generally allows more openness than may occur in large group settings. This flexibility enables exploration of nuances and subtleties of organizational dynamics and patterns of thinking. Non-verbal cues in response to topics (e.g. enthusiasm, caution, frustration or complacency) provide further insight into the organization. When

performed well, interviews help to establish credibility of the information gathered.

5.6.1. Working with interviews

Interviews serve to obtain in-depth information and points of view from individuals that are not bounded by the topics selected by the assessment team. They naturally satisfy an organization's request for involvement. From an assessor's perspective, they can help to gain deeper insight into the intensity of sentiment around issues or to explore the complex logic behind patterns. They give understanding of the different perceptions of accountability across organizational levels and by groups. They also naturally provide an avenue for exploring issues or tentative themes surfaced through other assessment methods.

5.6.2. Limitations and risks

Interviews are complex interactions and hence have limitations. For example, they are not anonymous, so interviewees may not be completely candid in their responses. Interviewers may be perceived as representing management and therefore evoke caution or anxiety in the interviewees, diminishing the quality of information gained. It is therefore important to ensure confidentiality and to inform the interviewee about the protocol. The level of rapport between interviewer and interviewee can influence the responsiveness of the interviewee.

A rigorous approach may be perceived as a test or interrogation if not handled well, thereby affecting the information and impressions gathered during the interaction. Interviews can provide an opportunity for interviewees to vent long standing complaints. These may provide insight into, or distract from, the aim of the interview. Hence, caution needs to be applied in extrapolating individual views. Depending on the type of interview, questions play a significant role in shaping the content and flow of conversation. Question design needs careful thought to avoid bias in the results. Finally, extracting themes from large volumes of interview transcripts is time consuming and complex. It can easily introduce bias based on what naturally attracts the reviewer's attention. Appendix VII provides additional information on interviews. (IAEA SRS 83, 2016, pp. 31-37)

As can be seen, there is much to using these methods in terms of a structured, yet flexible approach and avoidance of bias. Method selection is hence an important exercise, whereby many factors (e.g. complexity of organization, scope of assessment, capacity of the organization, etc.) need to be taken into consideration.

Analysis

While SRS 83 has a specific method to analyze safety culture assessment collected data, the main point worth highlighting here is the independent analysis of the different methods.

The results from a questionnaire are presented quantitatively as numbers and graphs. As shown in Fig. 7, the findings from interviews and other

> methods are presented as descriptive notes that capture the quality of interactions and experiences. Qualitative findings are not to be quantified or reduced to graphical representations because the value of the method will be lost. Instead, comparison across the quantitative and qualitative datasets needs to be undertaken at the level of conclusions and overarching themes. (IAEA SRS 83, 2016, p. 38)

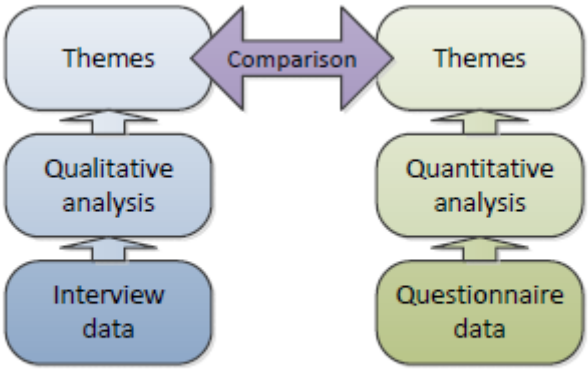


FIG. 7. Approaches to working with qualitative and quantitative data.

(IAEA SRS 83, 2016, p. 38)

As such, the collected data should be kept in independent streams until analyzed to a thematic level, at which point comparisons across methods can be made. Furthermore, while quantitative data lends itself to be represented in scores and charts, qualitative data is “descriptive notes that capture the quality of interactions and experiences”. Should qualitative data be reduced to a numerical representation, “the value of the method will be lost.”

7.3 Literature

As has been said, a multiplicity of methods is how safety culture assessments are undertaken. This is also known as triangulation in the literature.

> Triangulation refers to the combination of methodologies in the study of the same phenomenon (Denzin, 1978), whereby multiple reference points are used to locate an object's exact position (Smith, 1975). As such, given the appropriate measuring instruments, triangulation allows researchers to take a multifaceted view of safety culture, so that the reciprocal relationships between psychological, behavioural and situational factors can be examined with a view to establish antecedents, behaviour(s), and consequence(s) within specific contexts. Moreover, triangulation lends itself to testing the external validity of the `safety culture construct' (i.e. via a between-method validation process) and crosschecking each method involved in the triangulation process for internal consistency or reliability (i.e. via a `within-methods' triangulation approach). (Cooper, 2000, p. 120)

The specific methods are categorized in different ways in the following quotes:

> Safety culture assessment of an enterprise can take many forms, such as safety audits, interviews, observations, checklists, focus groups, error reports, or surveys based on personnel answers given to defined questionnaires. Each form of assessment has advantages and disadvantages, such as time, cost, need for specialized personnel, etc.
> The methods can be divided in two groups: *quantitative* and *qualitative*. With qualitative strategies, organization members serve as informants while in quantitative methods they usually serve as respondents. Quantitative methods are in general easy to implement, use and interpret the results. Qualitative approaches, on the other hand, are more complex, but more in-depth information can be obtained through them. As far as for the analysis methods, as data are either qualitative or quantitative, respectively, the method is either descriptive or normative.
> One important observation that one has to endure dealing with safety culture assessment is the fact that it is always desirable to use more than one data gathering methods; it is advised to use at least two methods. (Mkrtchyan & Turcanu, 2012, p. 12)

The advice here is to use at least two methods.

> Ideally, all five methods would be used in order to get the most comprehensive assessment of the safety culture. If this is not possible, it is beneficial to use methods that draw on different sources of information. Interviews, focus groups and questionnaires all capture employee attitudes, values and perceptions. Observation captures the safety culture in action, whereas document analysis provides information on the outcomes of culture. Therefore, safety culture assessment should contain at least one employee measure, observation and document review. (Fleming & Scott, n.d., p. 38)

This approach stipulates one employee attitude, observation, and document review as an ideal combination.

> In order to grasp such a complex and intangible phenomenon as culture, the organisation needs to be approached from several viewpoints. As mentioned earlier, the assessment team should explore psychological aspects, social processes and concrete structures and systems of the organisation, and for that a rich set of data is needed. Therefore, the final generic rule of a safety culture assessment is that it should always utilise multiple data collection methods, such as interviews, document analysis, observations, personnel surveys and group work (Oedewald & Gotcheva, 2015, p. 21).

Here, there is no parsing of the 5 preferred data collection methods. Other groups also describe and advocate for a multiplicity of data collection methods to assess safety culture (Cole, Kerstan S.; Stevens-Adams, Susan M.; Weneer, Caren A.; Sandia Labs, 2013; Mengolini & Debarberis, 2007; Mariscal, Herrero, & Otero, 2012; Choudhry, Fang, & Mohamed, 2007).

Notwithstanding the evidence that multiple methods are preferred, a popular way to assess safety culture is through questionnaires (surveys) exclusively.

> In the past years considerable effort has been put into the construction of a valid and reliable safety climate questionnaire. In safety culture research a (safety climate) questionnaire has been the predominant measurement instrument (Collins and Gadd, 2002; Guldenmund, 2000). (Guldenmund F. W., 2007, p. 724)

In fact, recent papers (Petitta, Probst, Barbaranelli, & Ghezzi, 2017; Warszawska & Kraslawski, 2016; Shirali, Shekari, & Angali, 2016) have suggested a purely quantitative (e.g. numbers driven) approach to safety culture. The research community has looked at the quantification of safety culture assessments:

> Research findings are almost never quantified because it is meaning and interpretation and not some numerical abstractions and calculations that drive research following this approach. Moreover, if (some) quantification occurs, numbers are never taken as data abstracted from an objective world, which would be in conflict with the research paradigm…. Put in another way, the thick descriptions of the academic approach provide a context for the answers gathered with the analytical approach. Aggregated numbers, like frequencies or means, do not offer much insight into an organizational safety culture, much less an understanding of it. (Guldenmund F. W., 2010, 1468-9)

As has been mentioned, the Schein model of safety culture has as its core a set of basic assumptions, which likely are not at a conscious level, but that drive perceptions, behaviour and actions. Getting to these core basic assumptions should be the goal of a safety culture self-assessment (Reader, Noort, Shorrock, & Kirwan, 2015).

> The different layers of culture call for distinct research methods. Artifacts are easy to observe and, consequently, can be directly registered without the help of organizational members' reports. However, it is very difficult to understand the real meaning of artifacts and the cultural aspects that lie behind them without conducting a deeper cultural analysis. Next, one can try to capture and analyze the values of an organization. The espoused values are relatively easy for organizational members to articulate and, thus, can be captured by written surveys and questionnaires (Guldenmund, 2007; Schein, 1992; Wilpert and Schöbel, 2007) that have been adequately designed for this purpose. Access to the basic assumptions is the most difficult aspect of analyzing a particular culture. Because basic assumptions are taken for granted and ingrained, organizational members who hold them are often not aware of them (Schein, 1985). Therefore, basic assumptions cannot be reached by directly asking employees about them. The deepest cultural level can only be revealed through a combination of novel qualitative methodological approaches (Schein, 1985; Wilpert and Schöbel, 2007) and time-consuming objective processes of data integration, deciphering, and interpretation (Schein, 1985). (de Castro, Gracia, Tomása, & Peiróa, 2017, p. 46)

Notwithstanding the realization that the more to the heart of safety culture one assesses, the more qualitative the approach is needed, the popularity of surveys remains. This is due in part to their convenience, and the ability to undertake comparisons. However, unlike what is often stated in safety culture reports, where an organization reports as a homogeneous entity, sub-cultures are a fact of organizations (Guldenmund F. W., 2010, p. 1474).

> … several different sub-cultures will emerge from, or form around, functional groups, hierarchical levels and organisational roles, with very few behaviours, beliefs, attitudes or values being commonly shared by the whole of the organisation's membership. In turn, these sub- cultures may either be in alignment, or at odds, with the dominating `cultural' theme. (Cooper, 2000, p. 113)

While this might not be surprising, the reporting of homogenous numbers of an organizations safety culture persists.

> … is very common, for example, to find safety climate studies aggregating their data to reflect multi-site samples, rather than site-specific samples. Although this has obvious appeal in increasing sample sizes, the disadvantages of introducing error variance outweigh this approach (i.e. people can only respond in relation to the prevailing safety climate in their place of work, not across organisations, industries or countries). A perusal of many such studies also shows that the within- and between-variance obtained from analysis of variances and/or correlations, and the associated sub-group sample sizes, or degrees of freedom are not being reported. (Cooper, 2000, p. 140)

This is compounded by the questionnaire not measuring the intended organizational level

> … the level of aggregation is an important point for reflection. Therefore, it is somewhat surprising that this point has not been given due attention in safety culture and climate research. For instance, when talking about the objects of attitudes one can seriously question whether these objects remain the same at different organisational levels. That is, it is at least doubtful that the attitude objects of individuals are the same as those for groups or organisations. Hence, when aggregating individual data to the level of an organisational group or unit, it is open to question whether the combined data actually correspond to an attitude object existing at that level. (Guldenmund F. W., 2000, p. 244)

Guldemund continues to say that aggregation can be warranted – but the methodological considerations must be taken into account (but rarely are). He is also skeptical of using surveys as the principal way to undertake safety culture assessments.

> So, what kind of information do we collect with questionnaires? Although we intend to uncover an underlying trait called culture, the questionnaires invite respondents to espouse rationalisations, aspirations, cognitions or attitudes at best, that is, the very thing called espoused values by Schein (1992). Obviously, one could still argue that behind all these espoused

> values the 'true' shared values, if any, hide, but it takes a lot of deciphering and a creative analyst to uncover these. (Guldenmund F. W., 2007, p. 727)

This is echoed by Cooper

> However, most research investigating this culture construct has tended to focus solely on the way people think (i.e. their values, beliefs, attitudes, perceptions) about various aspects of safety, via safety climate measures, which have tended to be used as surrogate measures of safety culture. Issues related to situational constraints and people's actual behaviour have tended to be ignored. (Cooper, 2000, p. 130)

The quality of the questionnaire can also be an issue

> The literature recognizes the need to use multiple data collection approaches (Gadd and Collins, 2002), since there is no single approach that can measure all of the factors related to safety culture simultaneously (e.g., norms, values, beliefs, attitudes, and behaviors). However, the literature also suggests that while most of those studying safety culture are using similar methodological approaches (e.g., interviews, surveys, observations), they are no standardized tools that can used across domains, e.g., not the same survey instrument (Weigmann, et al, 2002). This makes it difficult in some cases to compare results across studies (Gadd and Collins, 2002), and raises questions regarding the validation of the instruments that are being used. Clearly, both construct validity (the extent to which an assessment instrument actually measures what it is intended to measure) and discriminate validity (the power of an assessment instrument to differentiate between groups that have different levels of safety) are important, and thus is desired to use instruments that have been validated (Weigmann, et al, 2002) in future assessment activities. (Cole, Kerstan S.; Stevens-Adams, Susan M.; Weneer, Caren A.; Sandia Labs, 2013, p. 31)

This is a standard concern, seen elsewhere in papers on assessment of safety culture (Mkrtchyan & Turcanu, 2012, p. 18; de Castro, Gracia, Peiró, Pietrantoni, & Hernández, 2013; El-Jardali, Dimassi, Jamal, Jaafar, & Hemadeh, 2011). Survey based safety culture assessments, while well intentioned, may not be helping to understand the culture at all.

> The results have shown that the safety culture survey conducted before the gas blowout at Snorre Alpha largely failed to detect the organizational problems that were later identified by the incident investigations. The question that now remains is: Why didn't the survey identify more of the problems at Snorre Alpha?…The analysis presented here thus lends some support to Guldenmund's (2007) suspicion that questionnaire data tend to invite respondents' espoused cognitions or attitudes. In a survey on safety, it is all too obvious what constitutes the favourable answer. The risk is, therefore, that the respondents' answers reflect the way they feel they should feel, think and act regarding safety, rather than the way they actually do feel, think and act in this respect. The causal analysis, based primarily on interviews, offers richer information in this respect, as it

> allows for follow-up questions that are more able to generate information that goes beyond the safety rhetoric… If safety culture assessments are based on questionnaires alone, failures of foresight may be inevitable. While survey methods are not irrelevant for safety culture assessment, future studies of safety culture should aim to adopt the actors' point of view by utilizing qualitative methods for inquiry. (Antonsen, 2009, 249,252)

As identified here, respondents answering what they believe they should ("the safety rhetoric") as opposed to how they truly feel is a significant risk to the truthfulness of safety culture data. Surveys are not the only tool subject to this – interviews are social interactions that can easily be misunderstood. Below is a description of a way to interview for safety culture.

> Interviews are an essential data source for safety culture assessments. To gain rich and reliable data, we use loosely structured interview schemes and only seldom ask directly normative "safety culture questions". Rather, the interviews cover themes related to the everyday work tasks of the interviewee, perceptions of organisational practices and future development needs in the organisation, and conceptions of safety and risks in their domain. Some of the interviewees are good at reflecting the culture of their organisation; some talk mainly from the perspective of their own work and as such can be approached as representatives of the culture. Some interviewees can best be utilised as informants of concrete work processes or events, as they prefer not to reveal too much about their own or their organisation's conceptions, norms and beliefs. (Oedewald & Gotcheva, 2015, p. 21)

There is a study in the nuclear power domain that does take advantage of the richness of social science techniques, such as prolonged engagement, member checks, multiple methods and sources, and peer debriefing, as well as using analysis phases looking at artifacts, gaps (comparing and contrasting artifacts and espoused values) and basic assumptions analysis, using a construct called "Cultural Dynamics Images". "Whereas the artifact- and gap analysis identified similar safety-relevant issues in both plants, the assumption analysis revealed different underlying dynamics and assumptions contributing to these. Thus, changing the culture based solely on diagnosing manifestations on upper cultural levels (e.g., by means of questionnaires) runs the risk of ignoring important contributors to dysfunctional dynamics" (Schöbel, Klostermann, Lassalle, Beck, & Manzey, 2017, p. 48).

7.4 Nuclear benchmarking

Most nuclear power plant countries describe multiple methods safety culture assessments.

Belgium

> The Belgian Regulatory Body (mainly Bel V) has implemented a safety culture oversight process since 2010. In a nutshell, this process is based on field observations provided by inspectors or safety analysts during any contact with a licensee (inspections, meetings, phone calls…). These observations are recorded within an observation (excel) sheet – aiming at

> describing factual and contextual elements – and are linked to IAEA Safety Culture attributes. The process is fully operational.
> Operationally speaking, a "Safety Culture Coordinator" (SCC) is in charge of the observation analyses and reporting. Safety culture observations are assessed through four key safety dimensions: i.e. management system, leadership, human performance and learning. For each of these dimensions, observed safety culture strengths and weaknesses are yearly discussed with licensees. In case of a significant safety (culture) problem, direct reporting to the licensee is considered.
> On a regular basis, the SCC provides a series of reports. These reports aim at identifying early signs of safety problems and recording recurrent observations. As a result of this, it could be decided to analyse a licensee performance more in detail in order to understand the underlying causes of a problem or to focus inspections on specific aspects. On an annual basis, a detailed report is released and a synthesis is inserted within the yearly safety evaluation report transmitted to the concerned licensee. The content of this yearly safety evaluation report is discussed with the licensee in order to be sure that the regulatory concerns are understood. Pluri-annual safety culture assessments are also performed in order to obtain a deeper cultural picture of a nuclear installation.
> On the basis of these pluri-annual assessment, we perform an inspection dedicated to "Safety Culture Assessment". The aim of this inspection is to evaluate the assessment methodology applied by a licensee and the way improvement actions are taken. In addition, the results of the licensee assessment are compared with our own results. (Bernard, Benoît; Bel V (Belgium), 2017)
> …providing an observation is not only establishing a link between a statement and a dedicated attribute. The framework proposed by the Safety Guide GS-G-3.5 gives a good structure to identify and classify observations into general Safety Culture dimensions. But the important point is trying to describe what is behind the link and seeking to shed light on the underlying reasons as to [for example] why the rules were ignored. Then, observations are not context-free. What is at stake is a deep understanding of the work situation. (FANC/AFCN & Bel V, 2013, p. 3)

Specifically, in Belgium we can see not only various data collection avenues (inspection, meetings, phone calls) but the appreciation that "observations are not context-free. What is at stake is a deep understanding of the work situation."

Bulgaria

> In the period 2014-2015 a SC self-assessment was performed, which includes several stages:
> - Collecting data through interviews, questionnaires, review of documents, surveys and focus groups;
> - Compilation and analysis of collected data;

- Determination of strengths and areas for improvement requiring additional work;
- Preparation of a Programme of Corrective Actions for Safety Culture Improvement. (Bulgaria - contracting party report, 2016, p. 44)

Here we can see all five methods of data collection are mentioned.

China

> All NPPs carry out all-round nuclear safety culture assessment activities periodically, each assessment period lasting for nearly 2 months from the preparation, questionnaire investigation to interviews with employees. In the assessment process, leaders of NPPs pay high attention and employees take an active part, the demonstrated assessment results well agree with the status quo of the nuclear safety culture in the plant, and good practices and weaknesses in nuclear safety culture are identified, realizing closed-loop management for the development of nuclear safety culture. (China - contracting party report, 2016, p. 66)

In China, questionnaires and interviews are mentioned.

Finland

> STUK's Guide YVL A.3 sets general requirements for management systems. The new guide YVL A.3 is based on IAEA GS-R-3, and it includes detailed requirements for promoting good safety culture. The management system must support the characteristics of the organisational culture that promote good safety culture, and the management must express its commitment to safety. Safety culture expertise must be available for developing the safety culture. The development of the safety culture must be target oriented and systematic. The procedures used must strengthen a vigilant, questioning and initiative attitude at all levels of the organisation.... TVO [licensee] carries out regular safety culture surveys and more in-depth safety culture self-assessments to ensure that their safety culture is on a good level. (Finland - contracting party report, 2016, 37-8,67)

Here, we see mention specifically of safety culture expertise, as well as "more in-depth safety culture assessments" beyond the "regular safety culture surveys".

India

> All nuclear power stations of NPCIL (licensee) have established safety culture assessment and fostering system in accordance with the requirements of NPCIL HQI titled 'Assessment and Fostering of Safety Culture at Nuclear Power Stations' [NPCIL Head Quarter Instruction no. 0559]. The system involves both safety culture assessment based on documented data in the station and safety culture survey. (India - contracting party report, 2016, 72-73)

In India, reference not only to surveys but "documented data in the station" is mentioned for safety culture assessments.

Pakistan

> To effectively influence, monitor, and provide oversight of operators' safety culture, PNRA conducted a pilot project on the assessment of its own safety culture in collaboration with the IAEA. Data for the assessment was collected through observations, interviews of employees, focus group discussions, surveys and documents review. A program is being chalked out to enhance the strengths and overcoming the weak areas in order to improve the safety culture of the organization. PNRA also shared its safety culture assessment process with the licensees. (Pakistan - contracting party report, 2016, p. 67)

While this description of a safety culture assessment is of the regulator, all five methods of data collection are mentioned.

UK

> Where appropriate, ONR (regulator) carries out direct interventions to assess safety culture, this is often done in conjunction with the licensee. The approach taken is to carry out interviews and focus groups and to undertake thematic analysis of the output. ONR is developing guidance in this area and has formed an industry group to share experience and good practice. EDF NGL undertakes similar reviews of leadership and management at their operating stations and also carries out safety culture surveys and supporting workshops. (UK - contracting party report, 2016, p. 99)

Here, we see interviews and focus groups and specifically a thematic analysis mentioned regarding safety culture assessments.

Korea, US

While specific assessment methods were not described for these countries, the US has evaluated safety culture with surveys (Morrow, Koves, & Barnes, 2014), and Korea has listed a "safety culture evaluation" (Korea - contracting party report, 2016, p. 73).

7.5 Other industry benchmarking

Aviation has reported using questionnaires, but supplementing with semi-structured interviews of not only operational but administrative units to assess a safety culture in Swedish air traffic control (Ek, Akselsson, Arvidsson, & Johansson, 2007, p. 807) Other techniques are also included:

> Most of these authors have explored traditional questionnaire and survey techniques, but more and more, alternative safety culture assessment methods such as semistructured interviews, focus groups (Mearns, Kirwan, & Kennedy, 2009), behavioral observations, situational audits (Cox & Cheyne, 2000), decision-making scenarios (Keren, Mills, Freeman, & Shelley, 2009), and artefact analysis (Patankar & Sabin, 2010) are investigated. (Heese, 2012, p. 25)

There are insightful workshops as well

> The workshops are now a core element of the safety culture toolkit, and are considered essential for ensuring the questionnaire results are interpreted correctly and reliably. There are several cases where (as above) relying on questionnaire results alone could have led to a misunderstanding of safety culture; often issues were 'richer' and more complex than could be explained by the measures within the questionnaire. The importance of utilising group workshops to understand and validate safety culture data is a conclusion being reached in some other areas, e.g. medical safety culture (Waterson, 2012) where there are calls for 'methodological pluralism' beyond simple questionnaire use. (Mearns, et al., 2013, p. 130)

Rail also uses workshops in addition to surveys and traditional audits, but add safety performance "Key indicators of aspects of safety culture" (González, Esteban Coito; Patacchini, Anna; European Railway Agency, 2013, p. 27). While the NAS public transportation report acknowledges that "Various methods can be used to assess an organization's safety culture. Among the most common and frequently employed are direct observation, interviews, focus groups, surveys, and performance indicator tracking." The proposed safety culture assessment method is "the combination of a standard survey to provide general information followed by a series of interviews and focus groups to develop specific and in-depth information on issues emerging from the survey." (NAS Transit Cooperative Research Program Report 174, 2015, 8,10)

There is also a push for a quantitative approach

> While surveys and interviews are widely used, specific metrics are being developed in some industries to measure safety in a more quantitative way. In the aviation industry, for example, the Volpe Center is working with the FAA to create a runway incursion severity calculator that will categorize the outcome severity of runway incursions (Volpe Center Highlights, 2009). In the chemical industry, the Center for Chemical Process Safety recommends that "all companies and trade associations collect and report the three lagging metrics: Process Safety Incidents Count, Process Safety Incident Rate, and Process Safety Severity Rate" (Center for Chemical Process Safety, 2011). (NAS Transit Cooperative Research Program Report 174, 2015, p. 22)

While in motor vehicle studies, survey only approaches can be found (Şimşekoğlu & Nordfjærn, 2017) – the same was true in commercial shipping (Bhattacharya, 2015) – some rigour to the survey is recognized "The criterion validity of a safety climate scale should be assessed by correlations of its score with outcome data, which should be preferably collected by other methods than a questionnaire due to common method bias" (Li & Itoh, 2014, p. 132). Questionnaires and interviews were the main data collection methods in truck and bus safety, although a process of reporting results to senior management and the entire organization was also listed as part of safety culture assessment. (NAS Commercial Truck and Bus Safety Synthesis Program Synthesis 14, 2007, p. 15).

Healthcare, as previously discussed, is overwhelming the safety culture literature. In this review, most studies described in their methods various types of questionnaires only (Steyrer, Latzke, Pils, Vetter, & Strunk, 2011; Etchegaray & Thomas, 2012; Gallego, Westbrook, Dunn, & Braithwaite, 2012; Muralidhar, Taneja, & Ramesh, 2012; Weaver, et al., 2013; Hessels, Agarwal, Saiman, & Larson, 2017; Sexton, et al., 2017; El-Jardali, Dimassi, Jamal, Jaafar, & Hemadeh, 2011; Klemenc-Ketis, et al., 2017). There are some voices that try to encourage healthcare to diversify their methods (Flin, 2007; Singer & Vogus, 2013), and one study had a rich description of a non-survey based approach – specifically interviews.

> On the basis of the pilot, the interview questions were revised (Appendix 2). In addition, we decided not to tape record the interviews to increase participation rates and quality of interview responses. Interview responses were noted contemporaneously and the interview notes were confirmed with interviewees at the end of the interviews. The interviews were conducted in an informal manner to allow probing and exploring interviewees' responses in greater detail…Consent was given by all interviewees. Data saturation was achieved, meaning that no new information was gathered from new interviews. All interview responses were noted and collated together in an Excel spreadsheet for qualitative analysis…All interview notes were translated from Chinese to English. Researchers conducted content analysis to the interview notes to extract significant words or phrases from each interview. The meaning for each extracted word or phrase was defined and those expressing similar meanings were compared and either collated, rephrased, or divided into multiple themes. Common viewpoints from the notes and individual or alternate viewpoints by department were identified. Next, patterns that supported or did not support survey findings were identified. During these iterative processes through team meetings, team consensus was used to resolve any disagreements. Finally, the themes were defined and classified against the best fit for each SAQ dimension as the reference framework, for example, safety climate and teamwork climate. (Listyowardojo, et al., 2017, p. 256)

This description is nearly a how-to on how to conduct and analyze non recorded interviews, done in a maternity ward.

Oil and gas also has a quantitative push (Kun, Longjun, Rui, & Longjun, 2013) and survey only assessments (Filho, Andrade, & de Oliveira Marinho, 2010). This is substantiated by a review for oil and gas regulators.

> Self-completion questionnaires are the most commonly used method of evaluating safety culture in the offshore oil and gas industry. It is generally accepted that questionnaires assess safety climate, rather than culture, as questionnaires only capture the more tangible aspects of the safety culture (i.e., espoused value and artefact layers …)…. It is important to select a questionnaire that is valid and reliable… It is important to strike a balance between asking enough demographic questions to be able to investigate differences between groups while at the

> same time protecting employee‟s anonymity (e.g., there may only be one female crane operator who has worked offshore for more than a year). Providing anonymity to employees helps to ensure truthful responses are gathered, instead of responses that employees think management wants to hear…There are a wide range of safety culture assessment methods. In the offshore oil and gas industry the self-completion questionnaire is the most dominant methodology. Given the multi-layered nature of safety culture no one methodology can comprehensively assess the culture. (Fleming & Scott, n.d., 28,52)

One study looked at "retrospective interviewing" (seemingly data mining accident investigations) (Antonsen, Nilsen, & Almklov, 2017), but the NAS report has a much deeper understanding of safety culture methods.

> Methods to assess the perception of the culture include but are not limited to questionnaires, interviews, and focus groups. Policies, operating procedures, continuous vigilance and mindfulness, reporting processes, sharing of lessons learned and employee and contractor engagement support an operator's safety culture. Observations and audits of how each of these are being applied in the daily conduct of operations provide indications of the health of an organization's safety culture, including conformance with policies, adherence to operating procedures, practicing vigilance and mindfulness, utilizing reporting processes, integrating lessons learned and engagement of employees and contractors. Failure in application of these provides an indication of potential deterioration of the safety culture. Management shall review the results and findings of perception assessments, observations and audits and define how to improve application of the supporting attributes. (NAS Transportation Research Board | Special Report 321, 2016, p. 116)

The NAS oil and gas review of safety culture methods (not listed here) is insightful, thorough, and helpful. It emphasizes that different methods access different types of data (that method appropriateness is an important consideration) and that all methods could be problematic if done poorly.

NASA describes only surveys for its safety culture assessments (NASA, 2015, p. 24), as in mining (Martyka & Lebecki, 2014, p. 564) and the US forest service (Lane, et al., 2014, p. 5) – although the latter describes the process to develop a customized survey.

7.6 Summary

Safety culture is best analyzed using multiple methods, and not reduced to numbers in the analysis. Survey methods tend only to measure at best beliefs and values, and that only if the surveys are well done. All methods have their advantages and disadvantages – but multiple methods are needed to understand the many dimensions of safety culture. Many industries – including nuclear – recognize this, although industries' experience with safety culture likely is reflected in the methods they report using. Many studies report using multiple methods, even described processes, to assess safety culture.
REGDOC-2.1.2 is consistent with advocating multiple methods to assess safety culture, and ensuring the assessment approach is well founded.

8. Requirement 2 – Safety Culture Assessment - Framework

This section deals with the normative framework, or the content of an assessment of safety culture ("what" is assessed). The framework is typically a set of statements against which the culture is evaluated.

8.1 REGDOC contents

(Requirement)

3. Safety Culture Assessments

This section contains requirements and guidance applicable to Nuclear Power Plants.

Licensees shall conduct comprehensive, systematic and rigorous safety culture assessments at least every five years.

This section provides information for all other licensees.

(Guidance)

3.3.3 Assessment framework
Principle 5 reads "Safety culture assessment and improvement activities are informed by a defined framework of key characteristics known to reflect a healthy culture". A safety culture framework provides a basis for the systematic review of safety culture against a defined set of characteristics. It also provides a common vocabulary to facilitate communications, and aids in developing improvement plans to address the shared perceptions and attitudes of workers. There are several culture frameworks currently in use across a variety of organizations and licensee contexts.

Licensees should ensure that the safety culture assessment framework is mapped against the five safety culture characteristics (see Appendix A of this document). (CNSC, 2017, p. 12)

Appendix A - This Appendix provides guidance for all licensees.

The following list is a reference framework for demonstrating a commitment to safety, and describes five characteristics of a healthy safety culture. It includes observable and measurable indicators for each safety culture characteristic and can help licensees clearly demonstrate how they foster safety culture in their organization. The framework is adapted from the GS-G-3.5, The Management System for Nuclear Installations [6]; and IAEA Nuclear Security Series No. 7, Nuclear Security Culture [11]. Since healthy safety and security cultures have similar characteristics and indicators, these are consolidated. Indicators that apply only to security culture are marked with an asterisk (*).

- Safety is a clearly recognized value

- Accountability for safety is clear
- A learning organization is built around safety
- Safety is integrated into all activities in the organization
- A safety leadership process exists in the organization

Indicators (not listed here) follow each characteristic (CNSC, 2017, 15-16).

8.2 IAEA Documents

In the seminal IAEA document on safety culture, INSAG 4, the normative frameworks are in the appendix. The text that precedes the frameworks reads as follows:

> This Appendix identifies questions worthy of examination when the effectiveness of Safety Culture in a particular case is being judged. It is recognized that the list of questions cannot be comprehensive, nor can a list which is at all extensive be applicable to all circumstances. The objective of what follows is therefore to encourage all self-examination in organizations and individually rather than to provide a checklist for Yes/No answers. The main intent is to be thought provoking rather than prescriptive. With this understanding, this list can be extended by the reader. (IAEA, p. 22)

The frameworks that follow have categories and questions for a) Government and its organization b) Operating organizations c) Research organizations and d) Design organizations. Under the Operating organizations, the categories are:

- Corporate level safety policy
- Safety practices at corporate level
- Definition of responsibility
- Training
- Selection of managers
- Review of safety performance
- Highlighting safety
- Work-load
- Relation between plant management and regulators
- Attitudes of managers
- Attitudes of individuals
- Local practices
- Field supervision by management (IAEA, 1991, 23-29)

For each of the above categories, from 5 to 20 questions, which should not be used in a Yes/No binary, are suggested to be asked to interrogate that category.

Since INSAG 4, GS-G-3.1 and GS-G-3.5 defined the IAEA 5 characteristics that constitute the IAEA framework, as well as attributes corresponding to each characteristic.

(1) Safety is a clearly recognized value

a. The high priority given to safety is shown in documentation, communications and decision making
b. Safety is a primary consideration in the allocation of resources

c. The strategic business importance of safety is reflected in the business plan
d. Individuals are convinced that safety and production go hand in hand
e. A proactive and long term approach to safety issues is shown in decision making
f. Safety conscious behaviour is socially accepted and supported (both formally and informally)

(2) Leadership for safety is clear

a. Senior management is clearly committed to safety
b. Commitment to safety is evident at all levels of management
c. There is visible leadership showing the involvement of management in safety related activities
d. Leadership skills are systematically developed
e. Management ensures that there are sufficient competent individuals
f. Management seeks the active involvement of individuals in improving safety
g. Safety implications are considered in change management processes
h. Management shows a continual effort to strive for openness and good communication throughout the organization
i. Relationships between managers and individuals are built on trust

(3) Accountability for safety is clear

a. An appropriate relationship with the regulatory body exists that ensures that the accountability for safety remains with the licensee
b. Roles and responsibilities are clearly defined and understood
c. There is a high level of compliance with regulations and procedures
d. Management delegates responsibility with appropriate authority to enable clear accountabilities to be established
e. 'Ownership' for safety is evident at all organizational levels and for all personnel:

(4) Safety is integrated into all activities

a. Trust permeates the organization.
b. Consideration of all types of safety, including industrial safety and environmental safety, and of security is evident
c. The quality of documentation and procedures is good
d. The quality of processes, from planning to implementation and review, is good
e. Individuals have the necessary knowledge and understanding of the work processes
f. Factors affecting work motivation and job satisfaction are considered
g. Good working conditions exist with regard to time pressures, workload and stress
h. There is cross-functional and interdisciplinary cooperation and teamwork
i. Housekeeping and material conditions reflect commitment to excellence

(5) Safety is learning driven

a. A questioning attitude prevails at all organizational levels
b. Open reporting of deviations and errors is encouraged
c. Internal and external assessments, including self-assessments, are used
d. Organizational experience and operating experience (both internal and external to the installation) are used

e. Learning is facilitated through the ability to recognize and diagnose deviations, to formulate and implement solutions and to monitor the effects of corrective actions
f. Safety performance indicators are tracked, trended and evaluated, and acted upon
g. There is systematic development of individual competences
Attributes are followed by specific artefacts (not listed here) to assist in finding evidence to substantiate the existence of the attribute (IAEA, 2009, 99-107).

8.2.1 SRS 83

In this Safety Report, the normative framework for safety culture is based on the five IAEA safety culture characteristics in IAEA Safety Standards Series No. GS-G-3.5, The Management System for Nuclear Installations [4] (see Fig. 3). The five characteristics are broken down into attributes that describe important cultural aspects and provide a framework for what needs to be in place for a strong safety culture. (IAEA SRS 83, 2016, p. 9)

FIG. 3. Characteristics of a strong safety culture.

(IAEA SRS 83, 2016, p. 9)

Nuclear Industry

Throughout the nuclear operating industry, the INPO (also adopted by WANO) Traits of a Healthy Nuclear Safety Culture are prolifically used. The nomenclature here names the higher level categories *traits*, and the lower level categories *attributes*. The attributes are numbered below each trait, and behavioural examples (not listed here) accompany each attribute.

PA. Personal Accountability

PA1. Standards: Individuals understand the importance of adherence to nuclear standards. All levels of the organization exercise accountability for shortfalls in meeting standards.
PA2. Job Ownership: Individuals understand and demonstrate personal responsibility for the behaviors and work practices that support nuclear safety.
PA3. Teamwork: Individuals and work groups communicate and coordinate their activities within and across organizational boundaries to ensure nuclear safety is maintained

QA. Questioning Attitude

QA1. Nuclear is Recognized as Special and Unique: Individuals understand that complex technologies can fail in unpredictable ways.
QA2. Challenge the Unknown: Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before proceeding.
QA3. Challenge Assumptions: Individuals challenge assumptions and offer opposing views when they think something is not correct.
QA4. Avoid Complacency: Individuals recognize and plan for the possibility of mistakes, latent problems, and inherent risk, even while expecting successful outcomes.

CO. Effective Safety Communication

CO1. Work Process Communications: Individuals incorporate safety communications in work activities.
CO2. Bases for Decisions: Leaders ensure that the bases for operational and organizational decisions are communicated in a timely manner.
CO3. Free Flow of Information: Individuals communicate openly and candidly, both up, down, and across the organization and with oversight, audit, and regulatory organizations.
CO4. Expectations: Leaders frequently communicate and reinforce the expectation that nuclear safety is the organization's overriding priority.

LA. Leadership Safety Values and Actions

LA1. Resources: Leaders ensure that personnel, equipment, procedures, and other resources are available and adequate to support nuclear safety.
LA2. Field Presence: Leaders are commonly seen in working areas of the plant observing, coaching, and reinforcing standards and expectations. Deviations from standards and expectations are corrected promptly.
LA3. Incentives, Sanctions, and Rewards: Leaders ensure incentives, sanctions, and rewards are aligned with nuclear safety policies and reinforce behaviors and outcomes that reflect safety as the overriding priority.

LA4. Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority.
LA5. Change Management: Leaders use a systematic process for evaluating and implementing change so that nuclear safety remains the overriding priority.
LA6. Roles, Responsibilities, and Authorities: Leaders clearly define roles, responsibilities, and authorities to ensure nuclear safety.
LA7. Constant Examination: Leaders ensure that nuclear safety is constantly scrutinized through a variety of monitoring techniques, including assessments of nuclear safety culture.
LA8. Leader Behaviors: Leaders exhibit behaviors that set the standard for safety.

DM. Decision-Making

DM1. Consistent Process: Individuals use a consistent, systematic approach to make decisions. Risk insights are incorporated as appropriate.
DM2. Conservative Bias: Individuals use decision-making practices that emphasize prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop.
DM3. Accountability for Decisions: Single-point accountability is maintained for nuclear safety decisions.

WE. Respectful Work Environment

WE1. Respect is Evident: Everyone is treated with dignity and respect.
WE2. Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions, and raise questions. Differing opinions are respected.
WE3. High Level of Trust: Trust is fostered among individuals and work groups throughout the organization.
WE4. Conflict Resolution: Fair and objective methods are used to resolve conflicts.

CL. Continuous Learning

CL1. Operating Experience: The organization systematically and effectively collects, evaluates, and implements relevant internal and external operating experience in a timely manner.
CL2. Self-Assessment: The organization routinely conducts self-critical and objective assessments of its programs and practices.
CL3. Benchmarking: The organization learns from other organizations to continuously improve knowledge, skills, and safety performance.
CL4. Training: The organization provides training and ensures knowledge transfer to maintain a knowledgeable, technically competent workforce and instill nuclear safety values.

PI. Problem Identification and Resolution

PI1. Identification: The organization implements a corrective action program with a low threshold for identifying issues. Individuals identify issues completely, accurately, and in a timely manner in accordance with the program.
PI2. Evaluation: The organization thoroughly evaluates problems to ensure that resolutions address causes and extents of conditions commensurate with their safety significance.
PI3. Resolution: The organization takes effective corrective actions to address issues in a timely manner commensurate with their safety significance.
PI4. Trending: The organization periodically analyzes information from the corrective action program and other assessments in the aggregate to identify programmatic and common cause issues.

RC. Environment for Raising Concerns

RC1. SCWE Policy: The organization effectively implements a policy that supports individuals' rights and responsibilities to raise safety concerns and does not tolerate harassment, intimidation, retaliation, or discrimination for doing so.
RC2. Alternate Process for Raising Concerns: The organization effectively implements a process for raising and resolving concerns that is independent of line management influence. Safety issues may be raised in confidence and are resolved in a timely and effective manner.

WP. Work Processes

WP.1 Work Management: The organization implements a process of planning, controlling, and executing work activities such that nuclear safety is the overriding priority. The work process includes the identification and management of risk commensurate to the work.
WP2. Design Margins: The organization operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defense-in-depth, and safety-related equipment.
WP3. Documentation: The organization creates and maintains complete, accurate, and up-to-date documentation.
WP4. Procedure Adherence: Individuals follow processes, procedures, and work instructions.
(Institute of Nuclear Power Operators, 2012, 9-30)

It is worth noting the licensees have invested considerably in this framework – not only for their safety culture self-assessments, but for their safety culture monitoring panels, and have been used to begin meetings (similar to a "safety moment").

8.3 Literature

Frameworks are prolific in the literature.

> Studies in the pragmatic tradition prescribe in detail what an organization should do to advance to a "more developed" level of safety (culture), that is, what processes should be implemented supported by an accompanying structure. Geller's Total Safety Culture is a prime example of this approach,(56) and the IAEA requirements and characteristics for nuclear power plants are of a similar nature. (57–59) (Guldenmund F. W., (Mis)understanding Safety Culture and Its Relationship to Safety Management, 2010, p. 1470)

Below is a sample of such safety culture frameworks, some high level sampling from literature reviews, and other more complete frameworks from recent studies.

Looking at high level attributes/characteristics from literature reviews, first from the National Academy of Sciences:

> Zohar (1980) said that the dimensions that make up safety climate are:
> - Strong management commitment to safety,
> - Emphasis on safety training,
> - The existence of open communication links and frequent contacts between workers and management,
> - A general environment control and good housekeeping,
> - A stable workforce and older workers, and
> - Distinctive ways of promoting safety.
>
> The International Civil Aviation Organization (2005) noted that a good safety culture has the following attributes:
> - Senior management placing a strong emphasis on safety,
> - Staff having an understanding of hazards within the workplace,
> - Senior management's willingness to accept criticism and an openness to opposing views,
> - Senior management's fostering a climate that encourages feedback,
> - Emphasis on the importance of communicating relevant safety information,
> - The promotion of realistic and workable safety rules, and
> - Ensuring that staff are well educated and trained so that they understand the consequences of unsafe acts.
>
> Hudson (2001) suggested using the Reason (1997) dimensions of:
> - An informed culture,
> - A reporting culture,
> - A flexible culture,
> - A learning culture, and
> - A just culture.
>
> Fleming (2000) noted 10 elements of a safety culture maturity model:
> - Management commitment and visibility,

- Communication,
- Productivity versus safety,
- Learning organization,
- Safety resources,
- Participation,
- Shared perceptions about safety,
- Trust,
- Industrial relations and job satisfaction, and
- Training.

The Idaho National Engineering and Environmental Laboratory (2001) noted eight core components of total safety culture:

- Management commitment to safety;
- Job satisfaction;
- Training, equipment, and physical environment;
- Organizational commitment;
- Worker involvement;
- Coworker support;
- Performance management; and
- Personal accountability. (NAS Transit Cooperative Research Program Report 174, 2015, p. 100)

And from an academic review:

Sorensen (2002)

- Good organizational communication
- Good organizational learning
- Senior management commitment to safety
- Working environment that rewards identifying safety issues
- Participative management leadership style

Wiegmann et al. (2004)

- Organizational commitment
- Management involvement
- Employee empowerment
- Reward systems
- Reporting systems

INPO (2004)/WANO (2006)

- Everyone is personally responsible for nuclear safety
- Leaders demonstrate commitment to safety
- Trust permeates the organization
- Decision making reflects safety first
- Nuclear technology is recognized as special and unique
- A questioning attitude is cultivated
- Organizational learning is embraced
- Nuclear safety undergoes constant examination

HSE (2005)
- Leadership
- Two way communication
- Employee involvement
- Learning culture
- Just culture

IAEA (2006a,b)
- Safety is a clearly recognized value
- Leadership for safety is clear
- Accountability for safety is clear
- Safety is integrated into all activities
- Safety is learning driven

Choudhry et al. (2007)
- Management commitment to safety
- Management concerns for the workforce
- Mutual trust and credibility between management and employees
- Workforce empowerment
- Continuous monitoring, corrective action, review of system and continual improvements to reflect the safety at the work site

NRC (2011)
- Leadership safety values and actions
- Problem identification and resolution
- Personal accountability
- Work processes
- Continuous learning
- Environment for raising concerns
- Effective safety communication
- Respectful work environment
- Questioning attitude (de Castro, Gracia, Peiró, Pietrantoni, & Hernández, 2013, p. 233)

Looking at specific studies, one paper had the following framework,

Top level commitment to safety
1.1 Human resources
1.2 Material resources
1.3 Commitment to safety
1.4 Safety policy
1.5 Procedure management
1.6 Training programs
1.7 Competence selection

Organizational learning
2.1 Information dissemination
2.2 Information flow
2.3 Work management

2.4 Actual working practices
2.5 Local adaptations
2.6 Content of the documentation
2.7 Availability of the documentation
2.8 Analysis of incidents
2.9 Investigation of incidents and accidents

Organizational flexibility
3.1 Ability to control the unexpected
3.2 Capacity for flexibility
3.3 Professional recognition
3.4 Safe working limits
3.5 Reports of adaptations
3.6 Incorporation of adaptations

Awareness
4.1 Reports of problems
4.2 Information security
4.3 Communication mechanisms
4.4 Team work
4.5 Workload
4.6 Relations between people
4.7 Tasks and skills of people
4.8 Awareness of limitations
4.9 Preventative maintenance
4.10 Proactive actions

Just culture
5.1 Reporting of deviations/worries
5.2 Understanding of errors
5.3 Perception of errors
5.4 Actions are not punitive
5.5 Peer assessments

Emergency preparedness
6.1 Emergency preparedness plan
6.2 Identification of risks
6.3 Safety equipments
6.4 Alarm system
6.5 Proactive procedures
6.6 Training for emergencies on site (dos Santos Grecco, Vidal, Cosenza, dos Santos, & de Carvalho, 2014, p. 75)

A psychometric study proposed a high level framework of:

D1. Priority given to safety;
D2. Allocation of resources;
D3. Roles and responsibilities;
D4. Safety commitment;
D5. Qualification and personnel size;
D6. Communication;
D7. Relationship with superiors and regulators;
D8. Feasibility of processes;
D9. Documentation and procedures;
D10. Work conditions;
D11. Organizational learning;
D12. Internal and external evaluations. (do Nascimento, Andrade, & de Mesquita, 2017, p. 229)

Finally, a Finnish safety culture framework made for the nuclear lifecycle:

1. Safety is a genuine value in the organisation and that is reflected in decisionmaking and daily activities.
This means that safety manifests itself in the organisation's practices, documents and discussions, and in the individuals' selfreported opinions as a matter that is a necessity and meaningful in a positive sense. Safety is meaningful and important because itis genuinely considered to be right, well and good. Improved safety motivates. Compared with all other important organisational goals, safety gets a high priority.
2. Safety is understood to be a complex and systemic phenomenon.
This means that the prevailing safety conception in the organisation encompasses the following aspects
i. Safety is a dynamic property of activity that requires constant effort; it does not equal a lack of accidents, and it cannot be decomposed into simplified factors.
ii. Safety effects are not linear; small inputs can cause major effects therefore, the organisation constantly monitors its performance, and considers dealing with even minor issues.
iii. Safety is sociotechnical and influenced by the interaction of multiple stakeholders (individuals, groups, management, support functions, society). Each person and task has a potential to influence safety. Therefore, each person can describe the effect of his/her work on safety.

> The interfaces are important; thus the organisation promotes a good overview of work processes.
> iv. There are multiple types of safety in addition to operational safety (e.g. occupational safety, information security, security, environmental safety). Their special requirements (e.g. the different laws, different safeguarding measures) are taken into account.
> ***3. Hazards and core task requirements are thoroughly understood.***
> This means that the organisation has a good knowledge of phenomena that need to be managed in order to carry out the core task successfully. Especially a good understanding of hazards exists in all the organisation's functions and at all the personnel levels. Each actor knows the possible risks embedded in his/her work in relation to all types of safety.
> ***4. The organisation is mindful in its practices.***
> This means that the organisation is capable of maintaining a mindset that views the knowledge and practices as being imperfect, even though they are developed continually. The tolerance for expressing uncertainties is good, and organisational practices encourage questioning habits when these relate to identifying possible hazards. Risks are constantly monitored with the help of a variety of competencies and methods, because the organisation is aware of the possibility of new hazard mechanisms.
> ***5. Responsibility is taken for the safe functioning of the whole system.***
> This means that the organisation possesses an idea that every member has an opportunity and a responsibility to act for the safety of the whole system. Even though the official task descriptions are clear, there are practices and mindsets that encourage juridical accountabilities to be exceeded when safety may be affected for better or for worse. Dealing with safety issues is prompt: when a need for development is identified, no dodging or procrastination occurs.
> ***6. Activities are organised in a manageable way***.
> This means that there are sufficient resources for carrying out the work tasks with good quality. Staffing level, competencies, working conditions and work process knowledge are sufficient. Even exceptional work situations can be managed without chaos. (Oedewald, Pia; Gotcheva, Nadezhda; Viitanen, Kaupo; Wahlström, Mikael, 2015, 16-17)

Looking at the variety of frameworks, we can make a few observations. Firstly, the nomenclature and numbers of items differ.

> The number of safety culture dimensions varies significantly from one study to another. There is no consensus neither in terminology used (for example, characteristics, indicators, attributes, norms can refer to the same concept), nor in the concepts' definition even though there is a great degree of overlap between different tools and methods to this regard. In (Singla, 2006) among 23 safety culture dimensions some have been used in 85 % of surveyed tools, while other dimensions have very low overlapping degree (e.g., only one tool uses a certain dimension). (Mkrtchyan & Turcanu, 2012, p. 18)

Secondly, the specificity of a framework should not be too granular.

> In order to be useful, the Safety Culture framework must be at a sufficiently high level to allow broad adoption and use by all actors, not just one or a few. At the same time the framework must be sufficiently detailed to be meaningful for deeply understanding and improving an organisations specific Safety Culture. (Piers, Michel; Montijn, Carolynne; Balk, Arjen, 2009, p. 4)

Despite these differences, the frameworks bear more similarities than differences in their content, as was found between the IAEA and WANO frameworks (Mkrtchyan & Turcanu, 2012, p. 41). Frameworks should also be subject to scrutiny (de Castro, Gracia, Peiró, Pietrantoni, & Hernández, 2013).

One very important observation is that these safety culture frameworks are not anchored in the laws of physics, and tend to be used to measure perceptions or beliefs. This means…

> the more people tend to take a 'religious' approach in adopting or rejecting definitions. Such is the case for Safety Culture frameworks. This is not to say that the work done to develop such frameworks is not scientifically sound or not based on quality research and data. On the contrary, excellent peer reviewed scientific work underlies most Safety Culture frameworks. It is only to say that people tend to feel more at liberty to make their own judgement and not consider the elements of a Safety Culture framework as facts, than in other, more technical domains. (Piers, Michel; Montijn, Carolynne; Balk, Arjen, 2009, p. 4)

Hence, an issue with safety culture frameworks is their seemingly relative nature, and that people feel justified in an entirely subjective approach to safety culture that would not be tolerated in a more physics informed domain.

8.4 Nuclear benchmarking

Armenia, Belgium, Spain, Czech Republic, Finland, Ukraine

Armenia uses INSAG13 (INSAG13 "Management of Operational Safety in Nuclear Power Plants") for its assessment framework (Armenia - contracting party report, 2016, p. 18). Belgium uses the IAEA GSG 3.5 safety culture framework (FANC/AFCN & Bel V, 2013, p. 3), as does Spain (Barrientos, Marta; Gil, Benito; CSN (Spain), 2017) and the Czech Republic (Doležal, Radim; State Office for Nuclear Safety (Czech Republic), 2017). Finland (Finland - contracting party report, 2016, p. 36) and Ukraine (Ukraine - contracting party report, 2016, p. 33) refer to GSR3, which refers to GSG3.5; GSR3 has been rescinded by the IAEA in favour of GSR Part 2, although GSG3.5 is still endorsed by the IAEA. It should be noted that most of the above are nuclear regulators.

China, South Africa, United States, United Kingdom

The practice of a specific NPP in South Africa is typical of this group of countries. "The revision of safety culture traits by INPO/WANO necessitated a similar revision of the Koeberg NPP nuclear safety culture framework. In this instance, the Koeberg NPP adopted the safety culture traits of INPO/WANO as its own nuclear safety culture

framework" (South Africa - contracting party report, 2016, p. 49). This is also true in China (China - contracting party report, 2016, p. 66), the UK (United Kingdom-contracting party report, 2016, p. 83), and the US (US - contracting party report, 2016, 247-8).

8.5 Other industry benchmarking

Aviation has frameworks that reflect what the nuclear industry uses in its various frameworks. For example, a paper on air traffic management reports the backbone of an internationally accepted framework to include:

- Management commitment to safety
- Collaborating for safety
- Incident reporting
- Communications
- Colleague commitment to safety
- Safety support (Reader, Noort, Shorrock, & Kirwan, 2015, p. 774)

Another review in the aviation industry elaborated on the essential elements they found.

> From the review of the main existing and emerging Safety Culture frameworks in aviation and beyond, we know that Safety Culture is a multidimensional construct. To capture the common and keyelements of the various leading frameworks, six dimensions are needed. These dimensions are called Characteristics. The six Characteristics are:
> - Commitment: Commitment reflects the extent to which every level of the organization has a positive attitude towards safety and recognizes its importance. Top management should be genuinely committed to keeping a high level of safety and give employees motivation and means to do so as well
> - Behaviour: Behaviour reflects the extent to which every level of the organization behaves such as to maintain and improve the level of safety. From the management side, the importance of safety should be recognized and everything needed to maintain and enhance safety records should be put in place.
> - Awareness: Awareness reflects the extent to which employees and management are aware of the risks for themselves and for others implied by the organization's operations. Employees and management should be constantly maintaining a high degree of vigilance with respect to safety issues.
> - Adaptability: Adaptability reflects the extent to which employees and management are willing to learn from past experiences and are able to take whatever action is necessary in order to enhance the level of safety within the organization.
> - Information: Information reflects the extent to which information is distributed to the right people in the organization. Employees should be encouraged to report safety concerns. Work related information has to be communicated in the right way to the right people in order to avoid miscommunication that could lead to hazardous situations.

- Justness: Justness reflects the extent to which safe behaviour and reporting of safety issues are encouraged or even rewarded and unsafe behaviour is discouraged. (Piers, Michel; Montijn, Carolynne; Balk, Arjen, 2009, p. 6)

Rail also has elements of safety culture similar to aviation:

> Leadership and Commitment to Safety Culture
> Two Way Communication
> Stakeholder / Employee / Employee Representative Involvement
> A Learning Culture
> A Just Culture
> Non Punitive Reporting (González, Esteban Coito; Patacchini, Anna; European Railway Agency, 2013, 28-30)

The elements in public transportation are also not that different from aviation or nuclear.

> The 10 elements of the Safety Culture Maturity model are:
> 1. Management commitment and visibility,
> 2. Productivity versus safety,
> 3. Learning organization,
> 4. Safety resources,
> 5. Shared perceptions,
> 6. Communication,
> 7. Participation,
> 8. Trust,
> 9. Industrial relations and job satisfaction, and
> 10. Training. (NAS Transit Cooperative Research Program Report 174, 2015, p. 93)

Healthcare safety culture often is centered upon patient safety, as can be seen in a framework distilled from a review.

> We identified a broad range of safety culture properties that we organized into seven subcultures and defined as:
> 1. Leadership: Leaders acknowledge the healthcare environment is a highrisk environment and seek to align vision/mission, staff competency, and fiscal and human resources from the boardroom to the frontline.
> 2. Teamwork: A spirit of collegiality, collaboration, and cooperation exists among executives, staff, and independent practitioners. Relationships are open, safe, respectful, and flexible.
> 3. Evidence based: Patient care practices are based on evidence. Standardization to reduce variation occurs at every opportunity. Processes are designed to achieve high reliability.
> 4. Communication: An environment exists where an individual staff member, no matter what his or her job description, has the right and the responsibility to speak up on behalf of a patient.
> 5. Learning: The hospital learns from its mistakes and seeks new opportunities for performance improvement. Learning is valued among all staff, including the medical staff.

> 6. Just: A culture that recognizes errors as system failures rather than individual failures and, at the same time, does not shrink from holding individuals accountable for their actions.
> 7. Patient centered: Patient care is centered around the patient and family. The patient is not only an active participant in his own care, but also acts as a liaison between the hospital and the community. (Sammer, Lykens, Singh, Mains, & Lackan, 2010, p. 157)

It is noteworthy that is this framework, Just refers to errors as system failures rather than defaulting to individual accountability, which seems not to as clearly articulated in the other frameworks.

SafeCare BC, looking at workplace health and safety culture, determined the dimensions of safety culture to be:

1. Commitment to prevention and continuous improvement	Examines general commitment and attitudes towards prevention and continuous improvement, including purposes of policies and procedures.
2. Priority given to staff safety	Examines organizational priorities, as well as the role of risk management systems and the extent to which they are implemented.
3. Perceptions of the causes of staff safety incidents and their identification	Examines organizational understanding of the causes of incidents, reporting systems, and whether incidents are recognized as opportunities for blame or organizational improvement.
4. Investigating staff safety incidents	Examines extent to which incidents are investigated, how the information gathered is put to use, and timeliness of responses.
5. Organizational learning	Examines extent to which organizational learning is systematically integrated, and how change is implemented and managed.
6. Communication and consultation	Examines the extent to which there are formalized communication strategies and record keeping systems in place, as well as the degree of

	transparency between and within all levels of the organization.
7. Staff and safety issues	Examines organizational approach to recruitment, selection and retention of staff, including systems of support and performance appraisal.
8. Staff education and training about safety issues	Examines organizational approach to staff education, including motivation for training staff members, and extent of resources and support made available for training purposes.
9. Team and partnership working	Examines the extent to which the organization encourages team and partnership working between and within all levels of the organization.
10. Leadership commitment	Examines the extent to which leaders are trained regarding safety leadership behaviors, including interpersonal competencies, and techniques used to evaluate leadership performance (i.e., leading indicators).
11. Workload management	Examines the extent to which the organization recognizes and adheres to evidencebased staffing levels, and implements and monitors an active fatigue management plan.

(Thachuck, 2015, p. 6)

Moving to the oil and gas industry, characteristics very similar to those in the nuclear industry form their safety culture framework.

> … the Bureau of Safety and Environmental Enforcement (BSEE), one of the regulators of the offshore oil and gas industry, issued its *Safety Culture Policy Statement* in May 2013 to promote safety culture in the industry. The policy defined safety culture as "the core values and behaviors of all members of an organization that reflect a commitment to conduct business in a manner that protects people and the environment" and articulated nine characteristics or elements of a robust safety culture:• Leadership commitment to safety values and actions,

- Respectful work environment,
- Environment for raising concerns,
- Effective safety and environmental communication,
- Personal accountability,
- Inquiring attitude,
- Hazard identification and risk management,
- Work processes, and
- Continuous improvement. (NAS Transportation Research Board | Special Report 321, 2016, p. 4)

The IAEA framework is expanded in this pictorial representation of a safety culture framework. The publication is intended for regulators of the oil and gas industry.

(Fleming & Scott, n.d., p. 18)

Note the reflection of the Schein model in this diagram, with the outer circle representing artefacts, the middle circle (the IAEA characteristics) the values, and a core of basic assumptions. Interspersed with the desired artefacts are some red italicized undesirable artefacts that could threaten safety culture, and hence should be recognized and mitigated.

NASA has five central factors comprising their safety culture framework:

> The NASA Safety Culture Model is composed of the five factors of Reporting Culture, Just Culture, Flexible Culture, Learning Culture, and Engaged Culture. (NASA, 2015, p. 12)

In academia, an appreciation for the essentials of safety culture has also emerged. The bolded emphasis has been added to help elucidate the similarities with other frameworks presented.

> Numerous attempts have been made to identify the key attributes or characteristics of a positive safety culture, and although the various frameworks differ in the details, there are clearly more similarities than differences.
> For example, virtually all discussions of safety culture highlight the fundamental importance of **management commitment** and **active involvement**. Frameworks also emphasize the importance of **communication** and the **free exchange of safety related information**, especially the **freedom of all members** to report hazards and **to be heard** on matters involving safety. Positive safety cultures also place high importance on **hazard identification and control** as well as **continuous learning and improvement**. To a considerable extent, achieving a safety culture that emphasizes learning and improvement requires a culture that seeks and values information and that assigns **greater importance to problem solving than blame assignment**. Obviously, a positive safety culture is one in which a **high relative importance is assigned to safety** all the time, not just when it is convenient or does not threaten personal or institutional productivity goals. However, the strongest, most positive safety culture is established when **all members at all levels of the organization basically agree on the importance of safety**. (NAS Committee on Establishing and Promoting a Culture of Safety in Academic Research Laboratories, 2014, 24-25)

8.6 Summary

Frameworks vary in nomenclature and numbers of aspects to analyze safety culture in organizations. However, the core of these aspects (e.g. importance of leadership, teamwork and communication, learning and improving) are evident in all of the frameworks presented, as well as in the proposed framework in the REGDOC. It should be noted that in REGDOC 2.1.2, licensees are free to use any framework that they choose, so as long as they can map to the framework in the REGDOC. The framework in REGDOC-2.1.2 is consistent with safety culture frameworks used both in the nuclear industry and in other industries that have recognized the importance of safety culture.

9. Appendix - Maturity model

This section explores how maturity models of safety culture are used in the nuclear industry and other industries.

9.1 REGDOC content

The REGDOC has two appendices – Appendix B and C, both devoted to the concept of a maturity model.

> **Appendix B: Safety Culture Maturity Model**
> **This appendix provides guidance for all licensees.**
> Understanding how safety culture changes over time, both positively and negatively, is essential to fostering safety culture. The safety culture maturity model presented here, as well as the associated indicators in Appendix C, have been adapted from the following IAEA publications:
> - IAEA-TECDOC No. 1329, Safety Culture in Nuclear Installations: Guidance for Use in the Enhancement of Safety Culture [18]
> - INSAG-15, Key Practical Issues in Strengthening Safety Culture [99]
> - Safety Series Report No.11, Developing Safety Culture in Nuclear Activities – Practical Suggestions to Assist Progress [10]
>
> Note that specific activities or behaviours within an organization, group or team will often fit into more than one stage depending on the specific indicators used. Organizations, groups, or teams may fluctuate between these stages over time.
> The three stage descriptive safety culture maturity model below can be also used to assess security culture maturity, so that it can be monitored and improved.
>
> **Stage 1: Requirement-driven**
> **Safety is primarily reactive and driven by formal rules and management direction.**
>
> Safety is viewed principally as a technical and procedural issue related to worker safety. Adherence to established rules and externally imposed regulations become the overriding reasons for safety in the performance of work. Procedural violations are understood primarily as individual worker issues as opposed to an outcome of organizational processes. Most workers believe that safety is primarily a responsibility of management or a designated authority, and that safety requirements and procedures are generally imposed upon them by others.
>
> **Stage 2: Goal-driven**
>
> **Good safety performance becomes an organizational objective and is dealt with primarily in terms of safety goals.**
>
> There are processes and procedures for achieving safety goals. These processes are grounded in clear organizational objectives, which describe

how specific organizational values and goals relate directly to safety. Improvement initiatives are administered and monitored by suitably qualified and experienced persons, while workers have the option to contribute to improvements in safety performance. Safety targets are monitored for effectiveness and strengthened over time, and safety goals are systematically integrated across all areas. It is understood that worker performance depends on effective organizational systems.

Stage 3: Continually improving

Safety is seen as a continually improving and proactive process, beginning with all workers sharing a clear vision of and value for safety.

All workers, including managers and contractors are personally and actively involved in enhancing safety throughout the organization. Everyone has a clear understanding of safety-related requirements and how their own responsibilities contribute to achieving and sustaining enhancements to safety in their everyday tasks. Complacency towards risks and threats is identified and eliminated through attention to process safety, and all workers share a questioning attitude. (CNSC, 2017, p. 17)

Appendix C: Safety Culture Maturity Model Indicators and Specific Behaviours

This appendix provides information for Class II and Nuclear Substances licensees.

The following table lists indicators and describes specific behaviours related to the three stages of maturity of an organization's safety culture.

While the specific behaviors will not be reproduced here, the indicators in the table are: planning, communication and teamwork, response to errors, role of management, learning, value of safety ("safety-production balance") stakeholder relationships, value of diversity, adherence to processes, conflict management, systems view, performance management, feedback and training. (CNSC, 2017, 18-19)

9.2 IAEA Documents

In terms of maturity models two IAEA publications are of note: SRS 11 (1998) *Developing Safety Culture in Nuclear Activities – Practical Suggestions to Assist Progress* and TECDOC 1329 (2002) *Safety Culture in Nuclear Installations: Guidance for Use in the Enhancement of Safety Culture.*

The first publication of the IAEA on maturity models espoused a three stage model; Stage I — Safety Based Solely on Rules and Regulations (IAEA, 1998, p. 5) Stage II — Good Safety Performance Becomes an Organizational Goal (IAEA, 1998, p. 6) and Stage III — Safety Performance Can Always Be Improved (IAEA, 1998, p. 7). In each of these stages, the IAEA gives examples of behaviour and organizational processes (artifacts)

one would expect to see. Taking one of these examples – "human error" – this is explained in this model in the following way:

> (Stage I) • People who make mistakes are simply blamed for their failure to comply with the rules.
> (Stage II) • Management's response to mistakes is to put more controls in place via procedures and retraining. There is a little less blaming.
> (Stage III) • Almost all mistakes are viewed in terms of work process variability. It is more important to understand what has happened than to find someone to blame. This understanding is used to modify the work process. (IAEA, 1998, 5,6,7)

One can see the different responses to error as being indicative of the maturity of the safety culture. These types of examples are given for many aspect of organizational performance – from how the organization rewards its workers to how they interface with external organizations. The REGDOC's Appendix C is based heavily on SRS 11.

As opposed to a very detailed approach on specific artifacts, TECDOC 1329 takes a view of an overall decline in performance, possibly imperceptible to the organization unless they specifically watch and correct for it (or are confronted with a catastrophe and the decline is discovered retrospectively). They label a 5 stage model of decline;

Stage	*Name of stage*	*Characteristic of stage*
1	Over-confidence	Good past performance leading to self-satisfaction.
2	Complacency	Occurrence of minor events that are subjected to minimum self-assessment, and delay in improvement programmes.
3	Denial	Number of minor events increases, with possibly a more significant event. These are treated as isolated events. Findings from audits are considered invalid. Root cause analysis not used.
4	Danger	Several potentially serious events occur but management and employees reject criticism from audits or regulator, by considering their views biased. The oversight function is afraid to confront management.
5	Collapse	Regulator intervenes to implement special evaluations. Management is overwhelmed and may need to be replaced. Major and very costly improvement needs to be implemented.

(IAEA, 2002, p. 51)

As opposed to a model incorporating continual improvement, this model starts with an organization in peril and gets progressively worse. This view of maturity models does not necessarily encourage improving performance as much as avoiding poor performance. However, it is instructive to recognize artifacts in one's organization that indicate that safety culture needs far more attention.

9.2.1 SRS 83

While SRS 83 is not focussed on maturity models, they do mention safety culture maturity in terms of one of the five dimensions safety culture assessments can enhance organizational learning:

> Programme implementation — to provide information on the current state of the safety culture programme and level of maturity; (IAEA SRS 83, 2016, p. 15)

The other dimensions listed are concepts, behaviours, basic assumptions and impact.

9.3 Literature

Ron Westrum has been credited with the development of maturity model typology in 1988 (Westrum, 2004, p. ii22), and typically uses a three stage model.

> I would identify three typical patterns. The first is a preoccupation with personal power, needs, and glory. The second is a preoccupation with rules, positions, and departmental turf. The third is a concentration on the mission itself, as opposed to a concentration on persons or positions. I call these, respectively, pathological, bureaucratic, and generative patterns. These preferences create recognisable climates that affect the processing of information and other cognitive activities. The climate shapes activities such as communication, cooperation, innovation, and problem solving. (Westrum, 2004, p. ii23)

He gives some advice on maturity models in general:

> Dimensions ought to be clear enough so that individuals can locate their organisations on them. Otherwise, culture becomes an arcane matter that can only be measured by questionnaire. … The culture, then, represents those habits of thought and action by changing the culture, virtually everything can change—trust, openness, confidence, and even competence. A generative culture will make the best use of its assets, a pathological one will not. This is what the theory predicts, and what the case studies show. (Westrum, 2004, p. ii26)

He also states the importance of these maturity models, “To be able to work with and understand organisational culture, we need a typology of organisational environments.” (Westrum, 2004, p. ii27)

The importance of maturity models to assess development of safety culture has also been echoed in the literature, “Research also appears to have ignored the purpose of safety culture. Logic informs us that any attempts to develop or otherwise improve safety culture must, by definition, be goal directed.” (Cooper, 2000, p. 130) Regarding how these maturity models should be used, an organization can diagnose its current status, but “the main objective is to ascend the safety development hierarchy” (Guldenmund F. W., (Mis)understanding Safety Culture and Its Relationship to Safety Management, 2010, p. 1470).

Two aspects are worth highlighting regarding maturity models. One, as indicated by the two IAEA documents, one can both ascend the hierarchy, or descend it, and one must be

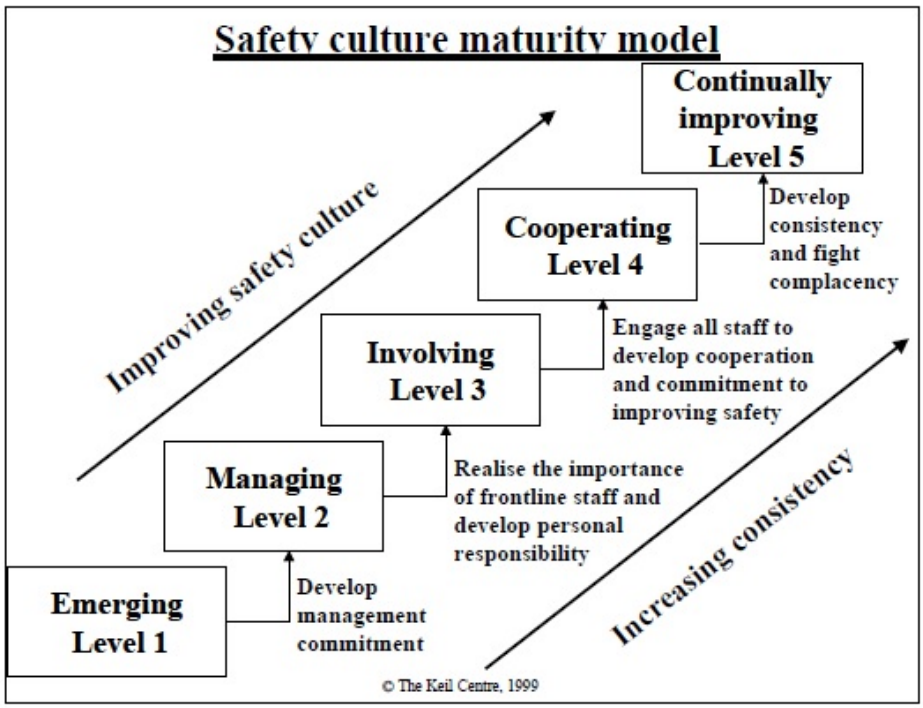
conscious of the possibility of going backwards. As well, it is very likely that an organization will not be completely in one level of maturity regarding all aspects of its functioning – more than one level of maturity is expected in a single organization for different aspects or the same aspect in different areas of the organization (IAEA, 2002; Filho, Andrade, & de Oliveira Marinho, 2010, p. 616).

9.4 Nuclear benchmarking

While not specifically searching for maturity models in any of the searching undertaken for this review, none of the nuclear industry benchmarking undertaken (nuclear industry specific literature, CNS – Convention on Nuclear Safety- reports or WGHOF – Work Group on Human and Organizational Factors - communications) spoke of maturity models with relation to safety culture.

9.5 Other Industry Benchmarking

Possibly the first industry to implement a maturity model was offshore oil and gas (Flemming, Mark; The Keil Centre, 2001; González, Esteban Coito; Patacchini, Anna; European Railway Agency, 2013, p. 31). It is based on a 5 level model:



(Flemming, Mark; The Keil Centre, 2001, p. 5)

Since its introduction, the Safety Culture Maturity© Model (SCMM) has assisted "organisations in establishing their current level of safety culture, identif[ying] the actions required to improve their safety culture. Note that this tool is recognized as one of the few tools that has employees' full involvement in the identification, assessment and follow up of safety related issues" (Mkrtchyan & Turcanu, 2012, p. 30). This tool was later adapted for use in healthcare – specifically patient safety. (Fleming & Wentzell, Patient Safety Culture Improvement Tool: Development and Guidelines for Use, 2008).

Public transportation has also adopted the Keil model in their assessment of safety culture (NAS Transit Cooperative Research Program Report 174, 2015, p. 92).

Aviation also has used maturity models in assessing safety culture, based principally on Hudson's language regarding maturity (Piers, Michel; Montijn, Carolynne; Balk, Arjen, 2009; Filho, Andrade, & de Oliveira Marinho, 2010).Oil and gas have used this model as well (Filho, Andrade, & de Oliveira Marinho, 2010).

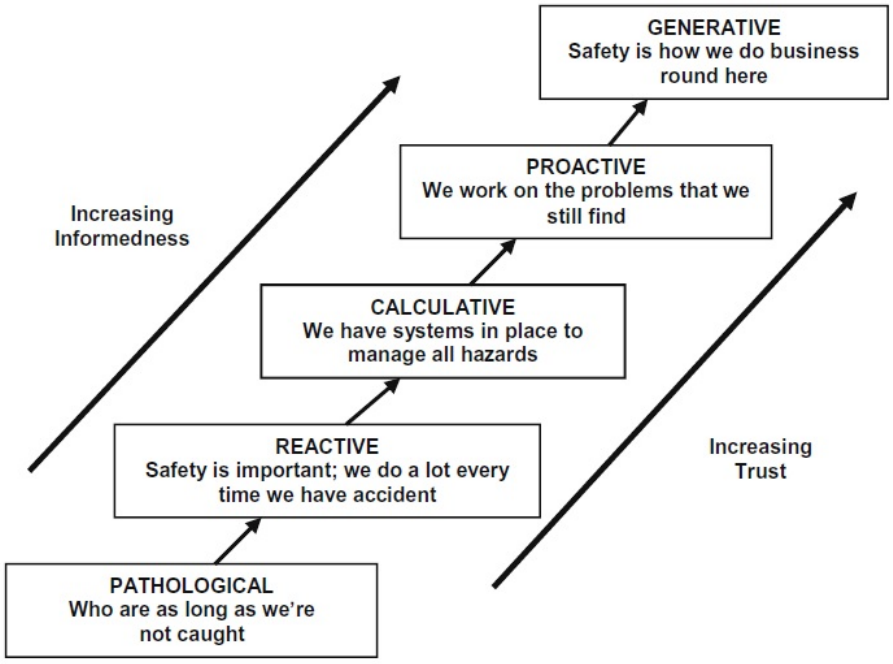


Fig. 1. Safety culture model of Hudson (2001).

(Filho, Andrade, & de Oliveira Marinho, 2010, p. 617)

Ostensibly the same as the Keil model, this incarnation uses the language of Westrum (pathological, generative) and has had an impact on safety culture evaluation (Piers, Michel; Montijn, Carolynne; Balk, Arjen, 2009).

Another organization that has promoted maturity models is the Civil Air Navigation Services Organization (CANSO), specifically in the uptake of Safety Management Systems (Heese, 2012; Schwarz & Kallus, 2015). Hence aviation (both operators and air traffic control) have maturity models in their evaluation of safety culture development.

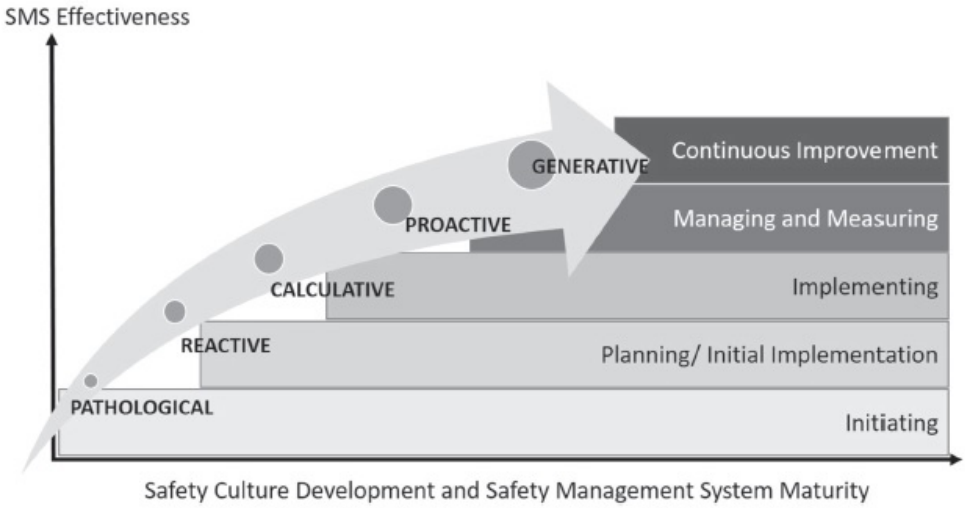
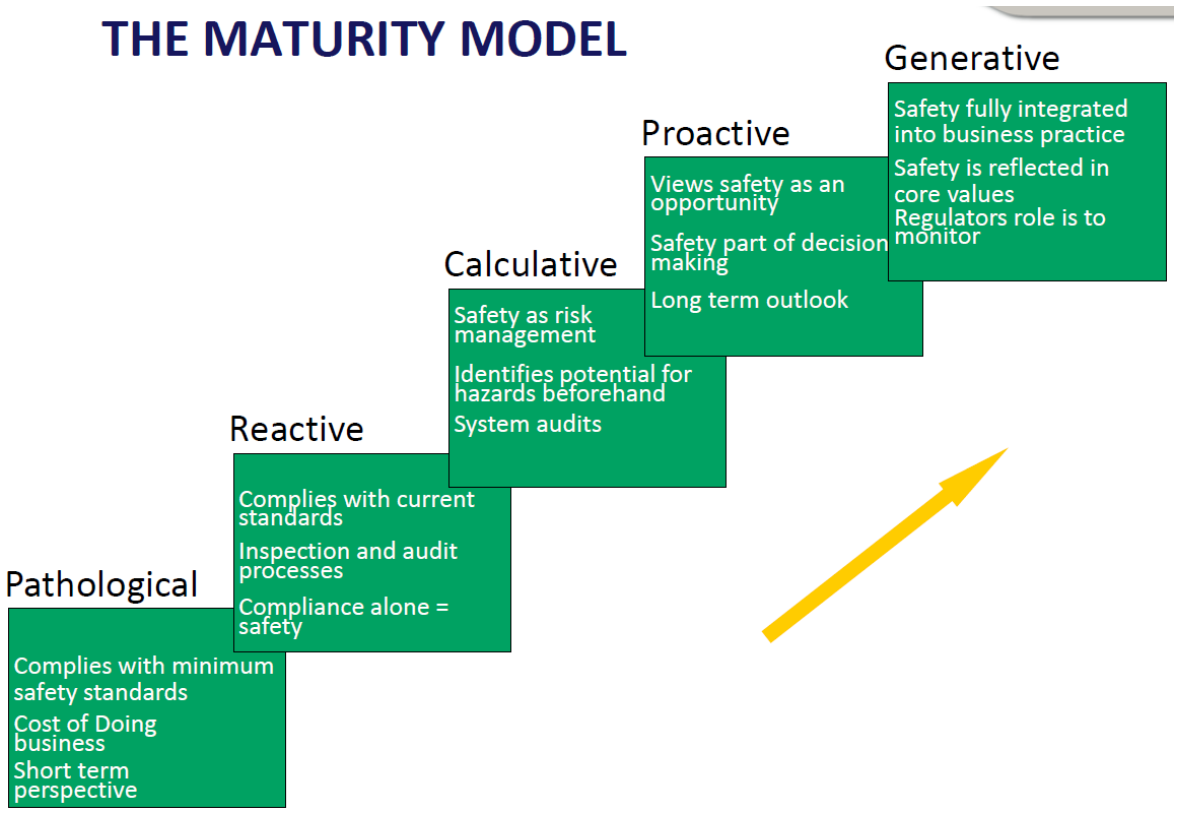


Figure 1. Safety culture development and safety management system (SMS) maturity levels combined. Adapted from *The CANSO Standard of Excellence in Safety Management Systems*, by the Civil Air Navigation Services Organisation (CANSO, 2009, 2014) and Fleming (2000). © 2009 by CANSO.

(Schwarz & Kallus, 2015, p. 4)

Based very much on the above models, the rail industry has also adapted a maturity model for their safety culture journey.



(Blais, Daniel;Transport Canada, 2014, p. 10)

Worksafe BC also adapted an extensive maturity model based on Fleming and Wentzell's paper in Healthcare Quarterly (Fleming & Wentzell, Patient Safety Culture Improvement Tool: Development and Guidelines for Use, 2008) and the Manchester Patient Safety Framework for their use in workplace health and safety culture within the continuing care setting (Thachuck, 2015).

LEVELS OF STAFF SAFETY CULTURE EXPLAINED

INCREASING MATURITY

LEVEL		DESCRIPTION
A	PATHOLOGICAL	Why do we need to waste our time on staff safety issues?
B	REACTIVE	We take staff safety seriously and do something when we have an incident.
C	CALCULATIVE	We have systems in place to manage staff safety.
D	PROACTIVE	We are always on alert, considering staff safety issues that might emerge.
E	GENERATIVE	Managing staff safety is an integral part of everything we do.

(Thachuck, 2015, p. 5)

In creating this document, the author spoke of being in line with applicable Accreditation Canada Required Organizational Practices and applicable health and safety regulation, but that including them in the maturity model would "run somewhat contrary to the very intent of safety culture frameworks, in that they are meant to broaden users' perceptions of safety and focus attentions on the complexity of how safety actually functions, above and beyond regulatory compliance" (Thachuck, 2015, p. 3).

And thus, it is the idea of maturity model to strive for the "generative" state, where continual improvement is the way normal work is routinely practiced.

9.6 Summary

The IAEA has had advice on maturity models since the late 90's, and while the nuclear industry has not embraced them, industries such as oil and gas, aviation (both civil and air traffic control), healthcare, rail and public transportation have used maturity models to develop and evolve their safety cultures. The REGDOC has a three stage maturity model, in line with the IAEA guidance, and to allow licensees unfamiliar with maturity models a simple model to follow.

Conclusion

This technical rational document is a synopsis of the literature and benchmarking (both inside and outside the nuclear field) that supports the approach taken in REGDOC-2.1.2 *Safety Culture*. The specific questions it sought to answer are “Is the approach taken in REGDOC-2.1.2 reasonable?” by asking the related question “Is the approach scientifically sound and consistent with the literature”? The literature was peer reviewed, and included seminal works, literature reviews of safety culture, and many industry specific reports. This document gives an introduction to the domain of safety culture, a brief history of safety culture at the CNSC, and the expectation of safety culture in various disciplines. It then looks at the REGDOC in question, highlighting the requirements and guidance through various lenses. All in all, REGDOC-2.1.2 is consistent with the literature reviewed, and hence the approach taken in REGDOC-2.1.2 Safety Culture is scientifically sound, and reasonable.

WGHOF Communication

Below is the text of the email that was sent out by the NEA on behalf of Suzanne Dolecki, Human and Organizational Factors Specialist at the CNSC and also Vice-Chair of the WGHOF group, on October 24, 2017.

Dear Colleagues,

During our meeting in September, I discussed the CNSC's work on the Regulatory Document on Safety Culture. I indicated during my 5M that I would follow-up with a short list of questions for benchmarking purposes. This information is vital to the success of our Safety Culture Regulatory Document as we are frequently asked about the approaches of other countries. Your input will be very useful to us so that we can demonstrate that we are aligned with international best practices on the regulatory oversight of safety culture. Your response by November 27th is very much appreciated.

Best Regards,

Suzanne Dolecki

CNSC Benchmarking Questions:

1. What expectations does the regulator have of its licensees on safety culture? Security culture? Documented commitment, ongoing monitoring, assessment, etc.)?
2. How are these expectations communicated? Regulation, information document, personal communication, etc?
3. What guidance does the regulator provide licensees to meet any expectations? (Formal in regulatory communications, informal in discussions, etc.) What references (if any) are used? (IAEA, WANO, WINS, GNSSN, etc.)
4. What role does the regulator have in oversight of licensees' safety culture? Security culture?
    - Perform safety and security culture assessments
    - Review licensee self-assessments
    - Receive reports of ongoing monitoring
    - Review of governing documentation for importance of safety and security culture
    - Other
5. What training has the regulator provided to its own staff on providing this oversight? Formal classroom training, on-the-job knowledge transfer with specialists, other.

Below is a list of the countries contacted through this NEA email. The countries and organizations who responded are highlighted.

Country	**Type of Organization**
Belgium	Technical Services Organization
Czech Republic	Regulator, Technical Services Organization
Finland	Regulator, Research Organization
France	Regulator, Technical Services Organization, Operator, Research Organization
Germany	Regulator, Technical Services Organization
Hungary	Regulator
India	Regulator
Italy	Operator
Japan	Regulator, Industry collaboration organization
Korea	Regulator, Technical Services Organization
Netherlands	Regulator
Norway	Research Organization
Poland	Operator, University
Romania	Regulator, Operator
Slovakia	Operator
Spain	Regulator, Operator
Sweden	Regulator, Operator
Switzerland	Regulator
Turkey	Regulator
United Kingdom	Regulator
United States	Regulator, Operator

Works Cited

Accreditation Canada. (2017). *Required Organizational Practices Handbook 2017 - Version 2*. Qmentum: https://store.accreditation.ca/

Antonsen, S. (2009). Safety Culture Assessment: A Mission Impossible? *Journal of Contingencies and Crisis Management, 17*(4), 242-254.

Antonsen, S., Nilsen, M., & Almklov, P. G. (2017). Regulating the intangible. Searching for safety culture in the Norwegian petroleum industry. *Safety Science, 92*, 232-240.

Argentina - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Armenia - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Australia - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Barrientos, Marta; Gil, Benito; CSN (Spain). (2017, November 23). WGHOF Email correspondance.

Belgium - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Bernard, Benoît; Bel V (Belgium). (2017, November 28). WGHOF Email correspondance.

Bhattacharya, Y. (2015). Measuring Safety Culture on Ships Using Safety Climate: A Study among Indian Officers. *International Journal of e-Navigation and Maritime Economy, 3*, 51-70.

Blais, Daniel;Transport Canada. (2014). *Developing a Tool to Measure and Improve the Safety Culture of Canada's Railway Industry.* Previous Summit Presentations: http://www.safetyculturesymposium.ca/presentations--resources.html

Bulgaria - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Canadian Nuclear Safety Commission. (2017, September 22). *SOR/2017-199 Class I Nuclear Facilities and Uranium Mines and Mills Regulations.* Canada Gazette Part II.

China - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Choudhry, R. M., Fang, D., & Mohamed, S. (2007). The nature of safety culture: A survey of the state-of-the-art. *Safety Science, 45*, 993–1012.

CNSC. (2004). *Draft Guidance for Licensee Self Assessment of Safety Culture.* Ottawa: CNSC e-Doc 71568.

CNSC. (2012). *DIS-12-07 Discussion paper on Safety Culture for Nuclear Licensees.* Ottawa: CNSC e-Doc 3996113.

CNSC. (2017). *Proposed REGDOC-2.1.2 Safety Culture.* Ottawa: Canadian Nuclear Safety Commission.

Cole, Kerstan S.; Stevens-Adams, Susan M.; Weneer, Caren A.; Sandia Labs. (2013). *SAND2013-2754 A Literature Review of Safety Culture.* Albuquerque, New Mexico: Sandia National Laboratories.

Cole, P., Hallard, R., Coates, R., Croft, J., Davies, K., Devine, I.,... Shaw, A. (2014). Developing the radiation protection safety culture in the UK. *Journal of Radiological Protection, 34*, 469-484. doi:10.1088/0952-4746/34/2/469

Cooper, M. D. (2000). Towards a model of safety culture. *Safety Science, 36*, 111-136.

CSA. (2012). *N286-12, Management System Requirements for Nuclear Facilities.* Mississauga: Canadian Standards Association.

de Castro, B. L., Gracia, F. J., Peiró, J. M., Pietrantoni, L., & Hernández, A. (2013). Testing the validity of the International Atomic Energy Agency (IAEA) safety culture model. *Accident Analysis and Prevention, 60*, 231-244.

de Castro, B. L., Gracia, F. J., Tomása, I., & Peiróa, J. M. (2017). The Safety Culture Enactment Questionnaire (SCEQ): Theoretical model and empirical validation. *Accident Analysis and Prevention, 103*, 44–55.

do Nascimento, C. S., Andrade, D. A., & de Mesquita, R. N. (2017). Psychometric model for safety culture assessment in nuclear research facilities. *Nuclear Engineering and Design, 314*, 227-237.

Doležal, Radim; State Office for Nuclear Safety (Czech Republic). (2017, November 11). WGHOF Email Correspondance.

dos Santos Grecco, C. H., Vidal, M. R., Cosenza, C. N., dos Santos, I. A., & de Carvalho, P. R. (2014). Safety culture assessment: A fuzzy model for improving safety performance in a radioactive installation. *Progress in Nuclear Energy, 70*, 71-83.

Ek, Å., Akselsson, R., Arvidsson, M., & Johansson, C. R. (2007). Safety culture in Swedish air traffic control. *Safety Science, 45*, 791-811.

El-Jardali, F., Dimassi, H., Jamal, D., Jaafar, M., & Hemadeh, N. (2011). Predictors and outcomes of patient safety culture in hospitals. *BMC Health Services Research, 11*(45), 1-12.

ENSI. (2016, December). *ENSI-AN-8980 Oversight of Safety Culture in Nuclear Installations: ENSI Report on Oversight Practice.* ENSI: https://www.ensi.ch/en/documents/oversight-of-safety-culture-in-nuclear-installations/

Etchegaray, J. M., & Thomas, E. J. (2012). Comparing two safety culture surveys: Safety Attitudes Questionnaire and Hospital Survey on Patient Safety. *BMJ Quality and Safety, 21*, 490-498. doi:10.1136/bmjqs-2011-000449

FANC/AFCN & Bel V. (2013). *Safety Culture Observations Tool Guidance.* December 19, 2017, from http://www.belv.be/images/pdf/guidance_sc_observations_ver_jan_2013.pdf

Filho, A. P., Andrade, J. C., & de Oliveira Marinho, M. M. (2010). A safety culture maturity model for petrochemical companies in Brazil. *Safety Science, 48*, 615-624.

Finland - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA.

Fleming, M., & Scott, N. (n.d.). *A Regulator's Guide to Culture and Leadership.* National Energy Board: https://apps.neb-one.gc.ca/REGDOCS/File/Download/707046

Fleming, M., & Wentzell, N. (2008). Patient Safety Culture Improvement Tool: Development and Guidelines for Use. *Healthcare Quarterly - Special Issue, 11*, 10-15;1-5.

Flemming, Mark; The Keil Centre. (2001). *Health and Safety Executive.* Offshore Technology Report 2000/49 Safety Culture Maturity Model: www.hse.gov.uk/research/otopdf/2000/oto00049.pdf

Flin, R. (2007). Measuring safety culture in healthcare: A case for accurate diagnosis. *Safety Science, 45*, 653-667.

France - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Gallego, B., Westbrook, M. T., Dunn, A. G., & Braithwaite, J. (2012). Investigating patient safety culture across a health system: multilevel modelling of differences associated with service types and staff demographics. *International Journal for Quality in Health Care, 24*(4), 311–320.

Germany - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

González, Esteban Coito; Patacchini, Anna; European Railway Agency. (2013, December 19). *Application guide for the design and implementation of a Railway Safety Management System.* http://www.era.europa.eu/Document-Register/Documents/Developing%20and%20Improving%20Safety%20Culture.pdf

Government of Canada. (2015, June 12). *SOR 2000-202 General Nuclear Safety and Control Regulations*. Justice Laws Website: http://laws.justice.gc.ca/eng/regulations/sor-2000-202/page-1.html

Government of Canada. (2017, January 1). *Nuclear Safety and Control Act (S.C. 1997, c. 9)*. Justice Laws Website: http://laws-lois.justice.gc.ca/eng/acts/N-28.3/index.html

Guldenmund, F. W. (2000). The nature of safety culture: a review of theory and research. *Safety Science, 34*, 215-257.

Guldenmund, F. W. (2007). The use of questionnaires in safety culture research – an evaluation. *Safety Science*, 723-743. doi:10.1016/j.ssci.2007.04.006

Guldenmund, F. W. (2010). (Mis)understanding Safety Culture and Its Relationship to Safety Management. *Risk Analysis, 30*(10), 1466-1480. doi:10.1111/j.1539-6924.2010.01452.x

Haapasaari, P., Helle, I., Lehikoinen, A., Lappalainen, J., & Kuikka, S. (2015). A proactive approach for maritime safety policy making for the Gulf of Finland : Seeking best practices. *Marine Policy, 60*, 107-118.

Haber, S., & Barriere, M. (1998). *Development of a Regulatory Organizational and Management Review Method AECB Project No. 2.341.2.* Ottawa: AECB e-Doc 3600943.

Haghighi, M., Taghdisi, M. H., Nadrian, H., Moghaddam, H. R., Mahmoodi, H., & Alimohammadi, I. (2017). Safety Culture Promotion Intervention Program (SCPIP) in an oil refinery factory: An integrated application of Geller and Health Belief Models. *Safety Science, 93*, 76-85.

Heese, M. A. (2012). Got the Results, Now What Do You Do? Safety Culture Transformation From Theory Into Practice. *Aviation Psychology and Applied Human Factors, 2*(1), 25-33. doi:10.1027/2192-0923/a000020

Hessels, A. J., Agarwal, M., Saiman, L., & Larson, E. L. (2017). Measuring patient safety culture in pediatric long-term care. *J Pediatr Rehabil Med*, 81-87. doi:10.3233/PRM-170432

Holger, Knissel;ENSI (Switzerland). (2017, November 21). WGHOF Email correspondance.

Human Performance Analysis. (2003). *Safety Culture Evaluation of the Davis-Besse Nuclear Power Station.* New York: Human Performance Analysis.

IAEA. (1991). *Safety Series No. 75-INSAG 4-Safety Culture.* Dec 18 2017, from http://www-pub.iaea.org/books/IAEABooks/3753/Safety-Culture

IAEA. (1998). *SRS 11 Developing Safety Culture In Nuclear Activities - Practical Suggestions to Assist Progress.* IAEA: http://www-pub.iaea.org/books/IAEABooks/5144/Developing-Safety-Culture-In-Nuclear-Activities-Practical-Suggestions-to-Assist-Progress

IAEA. (2002). *TecDoc 1329 Safety Culture in Nuclear Installations: Guidance for Use in the Enhancement of Safety Culture.* IAEA: http://www-pub.iaea.org/books/IAEABooks/6721/Safety-Culture-in-Nuclear-Installations-Guidance-for-Use-in-the-Enhancement-of-Safety-Culture

IAEA. (2009). *GS-G-3.5 The Management System for Nuclear Installations.* Dec 4, 2017, from http://www-pub.iaea.org/books/IAEABooks/8090/The-Management-System-for-Nuclear-Installations

IAEA GSR Pt 2. (2016). *General Safety Requirements No. GSR Part 2 Leadership and Management for Safety.* Dec 18, 2017, from http://www-pub.iaea.org/books/IAEABooks/11070/Leadership-and-Management-for-Safety

IAEA SF 1. (2006). Safety Fundamentals 1. Retrieved from IAEA: http://www-pub.iaea.org/books/IAEABooks/7592/Fundamental-Safety-Principles

IAEA SRS 83. (2016). *Safety Report Series 83: Performing Safety Culture Self-assessments.* Dec 18, 2017, from http://www-pub.iaea.org/books/IAEABooks/10742/Performing-Safety-Culture-Self-assessments

IAEA. (2013). *TECDOC 1707 Regulatory Oversight of Safety Culture in Nuclear Installations.* Retrieved from IAEA: http://www-pub.iaea.org/books/IAEABooks/10435/Regulatory-Oversight-of-Safety-Culture-in-Nuclear-Installations

India - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Indonesia - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Institute of Nuclear Power Operators. (2012). *INPO -12-012 Rev 1 Traits of a Healthy Nuclear Safety Culture.* Nuclear Regulatory Commission: https://www.nrc.gov/docs/ML1303/ML13031A707.pdf

Klemenc-Ketis, Z., Maletic, M., Stropnik, V., Deilkås, E. T., Hofoss, D., & Bondevik, G. T. (2017). The safety attitudes questionnaire – ambulatory version: psychometric properties of the Slovenian version for the out-of-hours primary care setting. *BMC Health Services Research, 17*(36), 1-7. doi:10.1186/s12913-016-1972-7

Korea - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Kun, C., Longjun, X., Rui, Y., & Longjun, B. (2013). Safety culture assessment of petroleum based on SMART. *Chin.J.Geochem, 32,* 273–280. doi:10.1007/s11631-013-0633-3

Lacoursière, J.-P., Dastous, P.-A., & Lacoursière, S. (2015). Lac-Mégantic Accident: What We Learned. *Process Safety Progress, 34*(1), 2-15.

Lane, V. R., Cordell, K., Zarnoch, S. J., Green, G. T., Poudyal, N., & Fox, S. (2014). *The Forest Service Safety Survey: Results from an Employee-Wide Safety Attitude Survey.* Asheville, NC: United States Department of Agriculture Forest Service.

Li, Y., & Itoh, K. (2014). Safety climate in trucking industry and its effects on safety outcomes. *Cogn Tech Work, 16*, 131-142. doi:10.1007/s10111-013-0252-0

Listyowardojo, T. A., Yan, X., Leyshon, S., Ray-Sannerud, B., Yu, X. Y., Zheng, K., & Duan, T. (2017). A safety culture assessment by mixed methods at a public maternity and infant hospital in China. *Journal of Multidisciplinary Healthcare, 10*, 253-262.

Lithuania - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Marine Safety and Security. (2016, June 22). *SOR/2016-163 Regulations Amending the Small Fishing Vessel Inspection Regulations.* Canada Gazette Part II.

Mariscal, M. A., Herrero, S. G., & Otero, A. T. (2012). Assessing safety culture in the Spanish nuclear industry through the use of working groups. *Safety Science, 50*, 1237-1246.

Martínez-Córcoles, M., Gracia, F., Tomás, I., & Peiró, J. M. (2011). Leadership and employees' perceived safety behaviours in a nuclear power plant: A structural equation model. *Safety Science, 49*, 1118-1129.

Martyka, J., & Lebecki, K. (2014). Safety Culture in High-Risk Industries. *International Journal of Occupational Safety and Ergonomics*, 561-572.

Mearns, K., Kirwan, B., Reader, T. W., Jackson, J., Kennedy, R., & Gordon, R. (2013). Development of a methodology for understanding and enhancing safety culture in Air Traffic Management. *Safety Science, 53*, 123-133.

Mengolini, A., & Debarberis, L. (2007). Safety culture enhancement through the implementation of IAEA guidelines. *Reliability Engineering and System Safety, 92*, 520-529.

Mkrtchyan, L., & Turcanu, C. (2012). *SCK•CEN-BLG-1085 Safety Culture Assessment Tools in Nuclear and Non-Nuclear Domains:Review of safety culture assessment tools.* Belgium: Belgian Nuclear Research Centre.

Mod Ali, N. (2008, June). Challenges in Promoting Radiation Safety Culture. *Journal of Nuclear Science and Technology, Supplement 5*, 623-626.

Morrow, S. L., Koves, K. G., & Barnes, V. E. (2014). Exploring the relationship between safety culture and safety performance in U.S. nuclear power operations. *Safety Science, 69*, 37-47.

Muralidhar, S., Taneja, A., & Ramesh, V. (2012). Patient safety culture-perception of health care workers in a tertiary care hospital. *International Journal of Risk & Safety in Medicine, 24*, 191-199.

Myers, D. J., Nyce, J. M., & Dekker, S. W. (2014). Setting culture apart: Distinguishing culture from behavior and social structure in safety and injury research. *Accident Analysis and Prevention, 68*, 25-29.

NAS Commercial Truck and Bus Safety Synthesis Program Synthesis 14. (2007). *The Role of Safety Culture in Preventing Commercial Motor Vehicle Crashes.* Washington D.C.: National Academy of Sciences.

NAS Committee on Establishing and Promoting a Culture of Safety in Academic Research Laboratories. (2014). *Safe Science : Promoting a Culture of Safety in Academic Research Laboratories.* Washington D.C.: National Academy of Sciences.

NAS Transit Cooperative Research Program Report 174. (2015). *Improving Safety Culture in Public Transportation.* Washington D.C.: National Academy of Sciences.

NAS Transportation Research Board | Special Report 321. (2016). *Strengthening the Safety Culture of the Offshore Oil and Gas Industry.* Wasshington D.C.: National Academy of Sciences.

NASA. (2015). *NASA-HDBK-8709.24 NASA safety culture handbook.* Washington D.C.: NASA.

National Energy Board. (2013, March 21). *SOR/2013-49 Regulations Amending the Onshore Pipeline Regulations, 1999.* Canada Gazette Part II.

National Research Council. (2014, October 29). *Lessons Learned from the Fukushima Nuclear Accident for Improving Safety of U.S. Nuclear Plants.* Retrieved from National Centre for Biotechnology Information: https://www.ncbi.nlm.nih.gov/books/NBK253947/

Nouailles-Mayeur, Anaïs; ASN (France). (2017, December 11). WGHOF Email correspondance.

Nuclear Energy Institute. (2014, March 31). *NEI 09-07 Rev 1 Fostering a Healthy Nuclear Safety Culture.* Nuclear Regulatory Commission: https://www.nrc.gov/docs/ML1414/ML14143A085.pdf

Oedewald, P., & Gotcheva, N. (2015). Safety culture and subcontractor network governance in a complex safety critical project. *Reliability Engineering and System Safety, 141*, 106-114.

Oedewald, Pia; Gotcheva, Nadezhda; Viitanen, Kaupo; Wahlström, Mikael. (2015). *VTT Technology 222 - Safety culture and organisational resilience in the nuclear industry throughout the different lifecycle phases.* VTT Technical Research of Finland Ltd.: http://www.vtt.fi/publications/index.jsp

Pakistan - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Petitta, L., Probst, T. M., Barbaranelli, C., & Ghezzi, V. (2017). Disentangling the roles of safety climate and safety culture: Multi-level effects on the relationship between supervisor enforcement and safety compliance. *Accident Analysis and Prevention, 99*, 77-89.

Phillps, P. (2008). *State of the Art Report (SOAR).* Ottawa: CNSC e-Doc 255856.

Piers, Michel; Montijn, Carolynne; Balk, Arjen. (2009, March 6). *Safety Management System and Safety Culture Working Group (SMS WG).* ECAST SMS and Safety Culture WG: http://www.ukfsc.co.uk/files/External%20Meetings/ECAST%201-09%20%20SMS%20WG%20update%20report%2012%20Mar%2009.pdf

Pilbeam, C., Doherty, N., Davidson, R., & Denyer, D. (2016). Safety leadership practices for organizational safety compliance: Developing a research agenda from a review of the literature. *Safety Science, 86*, 110-121.

Reader, T. W., Noort, M. C., Shorrock, S., & Kirwan, B. (2015). Safety sans Frontières: An International Safety Culture Model. *Risk Analysis, 35*(5), 770-789. doi:10.1111/risa.12327

Romania- contracting party report. (2016). *Convention on Nuclear Safety*. IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Sammer, C., Lykens, K., Singh, K. P., Mains, D. A., & Lackan, N. A. (2010). What is Patient Safety Culture? A Review of the Literature. *Journal of Nursing Scholarship, 42*(2), 156–165.

Schöbel, M., Klostermann, A., Lassalle, R., Beck, J., & Manzey, D. (2017). Digging deeper! Insights from a multi-method assessment of safety culture in nuclear power plants based on Schein's culture model. *Safety Science*, 38-49.

Schwarz, M., & Kallus, K. W. (2015). Safety Culture and Safety-Relevant Behavior in Air Traffic Management. *Aviation Psychology and Applied Human Factors, 5*(1), 3-17. doi:10.1027/2192-0923/a000068

Schwarz, M., Kallus, K. W., & Gaisbachgrabner, K. (2016). Safety Culture, Resilient Behavior, and Stress in Air Traffic Management. *Aviation Psychology and Applied Human Factors, 6*(1), 12-23.

Sexton, B. J., Adair, K. C., Leonard, M. W., Frankel, T. C., Proulx, J., Watson, S. R., Frankel, A. S. (2017). Providing feedback following Leadership WalkRounds is associated with better patient safety culture, higher employee engagement and lower burnout. *BMJ Quality and Safety, 0,* 1-10. doi:10.1136/bmjqs-2016-006399

Shirali, G. A., Shekari, M., & Angali, K. A. (2016). Quantitative assessment of resilience safety culture using principal components analysis and numerical taxonomy: A case study in a petrochemical plant. *Journal of Loss Prevention in the Process Industries, 40,* 277-284.

Sieracki, Diane; NRC (United States). (2017, November 28). WGHOF Email correspondance.

Şimşekoğlu, O., & Nordfjærn, T. (2017). The role of safety culture/climate and social cognitive factors for driving behaviors of Turkish professional drivers transporting petroleum products. *Journal of Risk Research, 20*(5), 650-663. doi:10.1080/13669877.2015.1118150

Singer, S. J., & Vogus, T. J. (2013). Reducing Hospital Errors: Interventions that Build Safety Culture. *Annu. Rev. Public Health, 34,* 373-396.

South Africa - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Spanish Nuclear Safety Council (CSN). (2017). NEA Work Group on Human and Organizational Factors (WGHOF) personal communication. e-Doc 500827.

Steyrer, J., Latzke, M., Pils, K., Vetter, E., & Strunk, G. (2011). Development and Validation of a Patient Safety Culture Questionnaire in Acute Geriatric Units. *Gerontology, 57*, 481–489. doi:10.1159/000322089

Tear, M. J., Reader, T. W., Shorrock, S., & Kirwan, B. (2016). Divergent perceptions of safety culture between occupational groups: the role of national culture. *Proceedings of the Human Factors and Ergonomics Society 2016 Annual Meeting*, 1622-1626.

Thachuck, A. (2015, June 15). *SafeCare BC Workplace Health and Safety Culture.* SafeCare BC: http://safecarebc.ca/wp-content/uploads/SafeCare-BC-Safety-Culture-Framework-2016.pdf

Transport Canada. (2007, December 13). *SOR/2007-290 Regulations Amending the Canadian Aviation Regulations (Parts I, III and VIII).* Canada Gazette Part II.

Transport Canada. (2015, February 6). *SOR/2015-26 Railway Safety Management System Regulations, 2015.* Canada Gazette Part II.

U.S. Fire Administration. (2015). *FA-342 National Safety Culture Change Initiative.* Emmitsburg, Maryland: U.S. Fire Administration.

UK - contracting party report. (2016). *Convention on Nuclear Safety.* IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

Ukraine - contracting party report. (2016). *Convention on Nuclear Safety*. IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

United Kingdom- contracting party report. (2016). *Convention on Nuclear Safety*. IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

US - contracting party report. (2016). *Convention on Nuclear Safety*. IAEA: http://www-ns.iaea.org/conventions/nuclear-safety.asp#1

van Nunen, K., Li, J., Reniers, G., & Ponnet, K. (2017 (in press)). Bibliometric analysis of safety culture research. *Safety Science*. https://doi.org/10.1016/j.ssci.2017.08.011

Viitanen, K., Gotcheva, N., & Rollenhagen, C. (2017). *NKS-381 Safety Culture Assurance and Improvement Methods in Complex Projects – Intermediate Report from the NKS-R SC_AIM*. Roskilde, Denmark: Nordic nuclear safety research (NKS).

Warszawska, K., & Kraslawski, A. (2016). Method for quantitative assessment of safety culture. *Journal of Loss Prevention in the Process Industries, 42*, 27-34.

Weaver, S. J., Lubomksi, L. H., Wilson, R. F., Pfoh, E. R., Martinez, K. A., & Dy, S. M. (2013, March 5). Promoting a Culture of Safety as a Patient Safety Strategy:A Systematic Review. *Annals of Internal Medicine, 158*(502), 369-374. doi:10.7326/0003-4819-158-5-201303051-00002

Westrum, R. (2004). A typology of organisational cultures. *Quality and Safety in Health Care, 13*, i22-i27. doi:10.1136/qshc.2003.009522

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Management System:
Safety Culture

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Preface

This regulatory document is part of the CNSC's Management System series of regulatory documents. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website.

Over the past few decades, experience in the international nuclear industry and other industries has demonstrated the importance of a healthy safety culture in maintaining the safety of workers, the public, and the environment. An organization that actively fosters a healthy safety culture can have a powerful influence on employee attitudes and behaviours, and consequently on individual and corporate safety performance.

Regulatory document REGDOC-2.1.2, *Safety Culture*, sets out requirements and guidance for fostering a healthy safety culture and for conducting safety culture assessments. It does the same for security culture. It is important to recognize that both nuclear safety and security and their cultures share the same overall objective, which is to limit the risk resulting from nuclear substances and associated facilities. The two cultures coexist and reinforce each other.

REGDOC-2.1.2 is intended to form part of the licensing basis for a regulated facility or activity within the scope of this document. It is intended for inclusion in licences as either part of the conditions and safety and control measures in a licence, or as part of the safety and control measures to be described in a licence application and the documents needed to support that application.

For proposed new facilities: This document will be used to assess new licence applications for Class I nuclear facilities and uranium mines and mills.

Guidance contained in this document exists to inform the applicant, to elaborate further on requirements or to provide direction to licensees and applicants on how to meet requirements. It also provides more information about how CNSC staff evaluate specific problems or data when they review licence applications. Licensees are expected to review and consider guidance; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements.

For existing facilities: The requirements contained in this document do not apply unless they have been included, in whole or in part, in the licence or licensing basis.

A graded approach, commensurate with risk, may be defined and used when applying the requirements and guidance contained in this regulatory document. The use of a graded approach is not a relaxation of requirements. With a graded approach, the application of requirements is commensurate with the risks and particular characteristics of the facility or activity.

An applicant or licensee may put forward a case to demonstrate that the intent of a requirement is addressed by other means and demonstrated with supportable evidence.

Important note: Where referenced in a licence either directly or indirectly (such as through licensee-referenced documents), this document is part of the licensing basis for a regulated facility or activity.

The licensing basis sets the boundary conditions for acceptable performance at a regulated facility or activity, and establishes the basis for the CNSC's compliance program for that regulated facility or activity.

Where this document is part of the licensing basis, the word “shall” is used to express a requirement to be satisfied by the licensee or licence applicant. “Should” is used to express guidance or that which is advised. “May” is used to express an option or that which is advised or permissible within the limits of this regulatory document. “Can” is used to express possibility or capability.

Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee’s responsibility to identify and comply with all applicable regulations and licence conditions.

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Safety Culture

1. Introduction

This section provides information for all licensees.

A healthy safety culture is a key factor in reducing the likelihood of safety-related events and mitigating their potential impact, and in continually improving safety performance. All workers, from senior managers downwards, have a shared responsibility to ensure that a healthy safety culture is a priority.

The term safety culture is standard terminology in many industries outside the nuclear industry. While the CNSC acknowledges that many definitions of safety culture exist, the CNSC defines safety culture as the characteristics of the work environment, such as the values, rules, and common understandings that influence workers' perceptions and attitudes about the importance that the organization places on safety. This definition is aligned with others being used in the nuclear industry, sharing common elements and overall goals. The approach, however, is holistic, and not restricted to only occupational health and safety.

The approach taken in this regulatory document is based upon the following principles:

Principle 1 Every organization has a safety culture.
Principle 2 Safety culture is influenced by external and internal factors including all workers.
Principle 3 Safety culture is complex and changes over time.
Principle 4 Safety culture needs to be assessed and monitored to achieve the common goal of understanding the organization's safety culture and limiting risk.
Principle 5 Safety culture assessment and improvement activities are informed by a defined framework of key characteristics known to reflect a healthy culture.

A healthy safety culture is an interpretation of how safety is integrated into everyday work and interactions, rather than a program to be managed. It is reinforced in how people, including leadership, work together to create a deeper understanding of the culture and its impacts on safety. Monitoring to understand safety culture forms the foundation for building systemic safety improvements over time. Monitoring may include a wide range of methods, from simple workplace observations and interactions to comprehensive assessments of safety culture in larger organizations. A mature and continually improving safety culture manifests itself through everyday safety-related discussions, decisions and actions. Additional information on understanding safety culture can be found in IAEA Safety Report Series 83, *Performing Safety Culture Assessments*, section 2.1 *Understanding Culture, Organizational Culture and Safety Culture* [1].

The CNSC defines security culture as the characteristics of the work environment, such as the values, rules, and common understandings that influence workers' perceptions and attitudes about the importance that the organization places on security.

Safety culture and security culture coexist through the shared common objective of limiting risk, and they share common goals and techniques for promotion and monitoring activities. In this document, "safety culture" denotes safety culture and security culture collectively, except where a distinction is made.

It is therefore key for all licensees to engage in fostering a healthy safety culture in their organizations.

1.1 Purpose

This regulatory document establishes requirements and guidance for fostering and assessing safety culture.

1.2 Scope

This document contains requirements and guidance for Class I licensees and uranium mines and mills. For all licensees, this document contains useful information; licensees are encouraged to use this document to help them learn more about their organizations' safety culture. This document provides more specific requirements and guidance related to safety culture, as an elaboration on the management system requirements contained in the CSA standard CSA N286, *Management system requirements for nuclear facilities* [2].

Nuclear power plants are subject to the requirements of sections 2 and 3, and are recommended to use the information and guidance of sections 1, 2, 3 and Appendices A & B.

Other Class I nuclear facilities and uranium mines and mills are subject to the requirement of section 2, and are recommended to use the information and guidance of sections 1, 2, 3 and Appendices A & B.

Class II and nuclear substance licensees have no formal requirements, but are recommended to use Appendix C, and the information of sections 1, 2 and 3.

1.3 Relevant legislation

The following provisions of the regulations made under the *Nuclear Safety and Control Act* are relevant to this regulatory document:

- Paragraph 3(1)(e) of the *General Nuclear Safety and Control Regulations* (GNSCR) states that an application for a licence shall contain "the proposed measures to ensure compliance with the *Radiation Protection Regulations*, the *Nuclear Security Regulations* and the *Packaging and Transport of Nuclear Substances Regulations, 2015*;"
- Paragraph 3(1)(k) of the GNSCR states that "An application for a licence shall contain the following information: the applicant's organizational management structure insofar as it may bear on the applicant's compliance with the Act and the regulations made under the Act, including the internal allocation of functions, responsibilities and authority;"
- Paragraphs 12(1)(a), (b), (c), (f) and (j) of the GNSCR state that "Every licensee shall
  (a) ensure the presence of a sufficient number of qualified workers to carry on the licensed activity safely and in accordance with the Act, the regulations made under the Act and the licence;
  (b) train the workers to carry on the licensed activity in accordance with the Act, the regulations made under the Act and the licence;
  (c) take all reasonable precautions to protect the environment and the health and safety of persons and to maintain security of nuclear facilities and of nuclear substances;…
  (f) take all reasonable precautions to control the release of radioactive nuclear substances or hazardous substances within the site of the licensed activity and into the environment as a result of the licensed activity; …

(j) instruct the workers on the physical security program at the site of the licensed activity and on their obligations under that program;…"

- Paragraphs 17(b), (c) and (e) of the GNSCR state that "Every worker shall…
  (b) comply with the measures established by the licensee to protect the environment and the health and safety of persons, maintain security, control the levels and doses of radiation, and control releases of radioactive nuclear substances and hazardous substances into the environment;
  (c) promptly inform the licensee or the worker's supervisor of any situation in which the worker believes there may be…(i) a significant increase in the risk to the environment or the health and safety of persons;…
  (e) take all reasonable precautions to ensure the worker's own safety, the safety of the other persons at the site of the licensed activity, the protection of the environment, the protection of the public and the maintenance of the security of nuclear facilities and of nuclear substances."
- Paragraph 21 (1) (a), (b), (c), (d), (e) of the GNSCR state that "Information that concerns any of the following, including a record of that information, is prescribed information for the purposes of the Act:
  (a) a nuclear substance that is required for the design, production, use, operation or maintenance of a nuclear weapon or nuclear explosive device, including the properties of the nuclear substance;
  (b) the design, production, use, operation or maintenance of a nuclear weapon or nuclear explosive device;
  (c) the security arrangements, security equipment, security systems and security procedures established by a licensee in accordance with the Act, the regulations made under the Act or the licence, and any incident relating to security; and
  (d) the route or schedule for the transport of Category I, II or III nuclear material, as defined in section 1of the *Nuclear Security Regulations*. *Security Regulations*."
- Subparagraph 4(a)(i) of the *Radiation Protection Regulations* states that "Every licensee shall implement a radiation protection program and shall, as part of that program,
  (a) keep the amount of exposure to radon progeny and the effective dose and equivalent dose received by and committed to persons as low as is reasonably achievable, social and economic factors being taken into account, through the implementation of
    (i) management control over work practices,"
- Subsection 1(1), of the *Nuclear Non-Proliferation Import and Export Controls Regulations* (NNIECR) defines various terms:
  Controlled nuclear equipment means the controlled nuclear equipment and the parts and components for controlled nuclear equipment referred to in the schedule.
  Controlled nuclear information means the controlled nuclear information referred to in the schedule.
  Controlled nuclear substance means a controlled nuclear substance referred to in the schedule.
  Transit means the process of being transported through Canada after being imported into and before being exported from Canada, in a situation where the place of initial loading and the final destination are outside Canada.
- Subsections (2), (3) and (4) of the NNIECR state that
  (2) All controlled nuclear substances are prescribed as nuclear substances for the purpose of paragraph (d) of the definition nuclear substance in section 2 of the Act, with respect to the import and export of those substances.
  (3) All controlled nuclear equipment is prescribed equipment for the purposes of the Act, with respect to the import and export of that equipment.

(4) All controlled nuclear information is prescribed information for the purposes of the Act, with respect to the import and export of that information, unless it is made public in accordance with the Act, the regulations made under the Act or a licence.

- Subsection 1(1) of the *Nuclear Security Regulations* (NSR) defines various terms:
  physical protection measure means an element or a combination of elements in place at a nuclear facility for its protection — or for the protection of nuclear substances at the facility — against potential adversaries.
  physical protection system means all of the physical protection measures in place at a nuclear facility.
  threat and risk assessment means an evaluation of the adequacy of an existing or a proposed physical protection system designed to safeguard against
  (a) intentional acts that could pose a threat to the security of a high-security site; and
  (b) the exploitation of weaknesses in the physical protection measures of a high-security site.
- Paragraph 3 (c) (f) and (g) of the NSR state that
  (3) An application for a licence in respect of Category I or II nuclear material, other than a licence to transport, and an application for a licence in respect of a nuclear facility referred to in paragraph 2(b) shall contain the following information…:
  (c) a description of the proposed security equipment, systems and procedures;
  (f) the proposed plan and procedures to assess and respond to breaches of security; and
  (g) the current threat and risk assessment.
- Paragraph 3 of the *Class I Nuclear Facilities Regulation* states that "An application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall contain…
  (d) the proposed management system for the activity to be licensed, including measures to promote and support safety culture.
- Paragraph 3 of the *Uranium Mines and Mills Regulation* states that "An application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain…(b) in relation to the activity to be licenced…
  (v) the proposed management system for the activity, including measures to promote and support safety culture.

1.4 Relevant national and international standards

The International Atomic Energy Agency (IAEA) has identified the need for regulators and licensees to address safety culture. The IAEA's framework that supports safety culture is embedded in several safety standards documents and safety guides. Safety culture is reflected throughout IAEA Safety Standards Series No. SF-1, *Fundamental Safety Principles* [3]. This document includes principles concerning the licensee's primary responsibility for safety, the integration of safety culture with the management system, and the prevention of accidents through the application of defence in depth (SF-1 principles 1, 3, and 8, respectively). SF-1 also underscores the importance of integrating safety and security.

Key principles and elements used in developing this regulatory document are consistent with SF-1, as well as national and international standards, guides and practices. In particular, this regulatory document complements:

- CSA standard N286-12, Management system requirements for nuclear facilities [2]
- the following IAEA publications:
  - Safety Report Series No. 83 Performing Safety Culture Self Assessments [1]
  - GSR Part 1, *Government, Legal and Regulatory Framework for Safety* [4]
  - GSR Part 2, *Leadership and Management for Safety* [5]
  - GS-G-3.5, *The Management System for Nuclear Installations* [6]

- NS-G-2.4, *The Operating Organization for Nuclear Power Plants* [7]
- INSAG-24, *The Interface Between Safety and Security at Nuclear Power Plants* [8]
- INSAG-15, *Key Practical Issues in Strengthening Safety Culture* [9]
- Safety Reports Series No.11, *Developing Safety Culture In Nuclear Activities* [10]

1.4.1 Security culture

Canada is a signatory to the *Amendment to the Convention on the Physical Protection of Nuclear Material* [11], which obliges member states to apply all Fundamental Principles described therein. One of these concerns security culture.

> Fundamental Principle F: *Security Culture*
> All organizations involved in implementing physical protection should give due priority to the security culture, to its development and maintenance necessary to ensure its effective implementation in the entire organization[11, pg5].

In IAEA Nuclear Security Series No. 7, *Nuclear Security Culture*, [12] the IAEA has identified the need for licensees, regulators, and states to establish an effective nuclear security culture. This will provide greater assurance of preventing, detecting, delaying and responding to theft, sabotage, unauthorized access, illegal transfer, or other malicious acts involving a nuclear substance, prescribed equipment or prescribed information use, storage, or transport.

As mentioned, security culture and safety culture coexist and mutually reinforce one another. Analysis of the characteristics and indicators of both cultures demonstrates significant alignment between the two. The differences are few and could be captured within a single embracing culture without significant process and material change to that in place to currently enhance safety culture.

The combined approach to fostering these cultures in a mutually supporting framework or policy is anticipated to result in mutually supporting activities that foster and enhance an inclusive culture while reducing duplication of effort. An approach of integration of these cultures provides an effective and efficient process which reduces the overall resources required for fostering culture and enables a more comprehensive and consistent approach to enhancement of the culture. Sharing operational experience and knowledge of safety culture development and enhancement methods could assist in enhancing and fostering the security culture characteristics and traits within an existing and mature culture model.

In addition, this regulatory document is based in part on the following publications:

- IAEA TECDOC No. 1801, *Management of the Interface between Nuclear Safety and Security for Research Reactors* [13]
- IAEA Nuclear Security Series No. 20, *Objective and Essential Elements of a State's Nuclear Security Regime* [14]
- IAEA Nuclear Security Series No. 13, *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities* (INFCIRC/225/Revision 5) [15]
- IAEA Nuclear Security Series No. 14, *Nuclear Security Recommendations on Radioactive Material and Associated Facilities* [16]

2. Fostering Safety Culture

This section contains requirements and guidance applicable to all Class I facilities, and Uranium Mines and Mills.

Licensees shall document their commitment to fostering safety culture in their governing documentation.

This section provides information for all other licensees.

Guidance

2.1 Safety culture governance documentation

Principle 1 reads "Every organization has a safety culture," which should be reflected in an organization's governing documentation. Licensees are responsible for fostering a healthy safety culture through promoting and reinforcing a collective commitment to safety that is responsive to the risk and complexity of the licensed activities. To achieve this, licensees should use all available avenues, including a reliance on governing documentation (e.g., policies, processes, procedures, and manuals) to define and manage safety goals and performance objectives. This helps provide context to the requirements concerning safety culture found in CSA standard CSA N286, *Management system requirements for nuclear facilities* [2].

The highest level of governing documentation should make safety the utmost priority – overriding the demands of production and project schedules and forming a basis for promoting a healthy safety culture, including a questioning attitude and a commitment to excellence in the performance of all activities important to safety. Governing documentation may describe the leadership role(s) encompassing the highest levels of responsibility for safety matters, as well as areas where workers share safety responsibility. Leaders may use governing documentation to demonstrate key safety behaviours to workers, while ensuring workers understands their defined safety responsibilities, goals and performance objectives. Promoting and reinforcing a collective commitment to safety includes the continual improvement and practical use of all governing documentation.

2.2 Ongoing monitoring of safety culture

Principle 4 reads "Safety culture needs to be assessed and monitored to achieve the common goal of understanding the organization's safety culture and limiting risk." Ongoing (essentially continuous) monitoring is a key activity to fostering a healthy safety culture. Monitoring safety culture provides management the means as to how safety manifests itself in everyday discussions, decisions and actions. Licensees have many processes and activities providing insight on safety culture, some of which are listed below. These should be periodically viewed, through the licensee's management review processes, with a safety culture lens, aiming to increase awareness of the organization's safety culture. Where monitoring activities identify improvement opportunities, consideration should be given to prioritizing and implementing these improvements.

Examples of safety culture monitoring data sources which management can leverage for discussion and analysis include:

- surveys, including topic-based surveys, worker surveys in focused areas, and follow-up surveys
- safety-related focus groups, town hall sessions or feedback tools
- opportunities for workers to discuss and reflect on their personal roles and responsibilities for safety
- seeking feedback on specific focus areas from workers, management, regulators, contractors or stakeholders
- trending and analysis of leading organizational performance indicators, and other organizational audits and evaluations
- trending and analysis of operational performance indicators detected through routine monitoring
- reflecting on formal and informal dialogue focused on safety between management and other workers
- potential for changes in safety culture following significant organizational changes, such as change in ownership, structure or responsibilities
- reporting of and responses to near misses, events or incidents

Additional information on ongoing monitoring of safety culture may be found in NEI 09-07 Revision1, *Fostering a Healthy Nuclear Safety Culture* [17].

For licensees undertaking safety culture assessments, ongoing monitoring offers a complementary method for monitoring safety culture health between safety culture assessments. For example, these monitoring activities can inform future assessments, such as through trending indicators from previous safety culture assessments. Additionally, information from monitoring activities conducted can be analyzed and understood in the context of safety culture assessment results. For example, insight from completed assessments may suggest new monitoring activities, or be used to refine existing monitoring activities.

The three-stage safety culture maturity model described in appendix B is a useful tool to initially establish a safety culture maturity baseline and to monitor changes over time. Safety culture maturity progress can then be tracked with suitable records.

3. Safety Culture Assessments

This section contains requirements and guidance applicable to Nuclear Power Plants.

Licensees shall conduct comprehensive, systematic and rigorous safety culture assessments at least every five years.

This section provides information for all other licensees.

Guidance

A safety culture assessment involves systematically gathering, reviewing and analyzing culturally relevant data, as well as identifying and implementing improvement actions. This is to promote safety, learn about organizational factors affecting safety, and to continually seek an understanding of how culture operates within the organization.

Principle 2 reads "Safety culture is influenced by external and internal factors including all workers". Organizations engaged in complex work involving many interdependent workers and processes can benefit from safety culture assessments.

Principle 3 reads "Safety culture is complex and changes over time." Changes in the organization can affect the safety culture – assessments should be carried out as operational needs dictate (new ownership, governance, structure, responsibilities or new activities such as refurbishment, decommissioning, etc.).

A safety culture assessment provides an opportunity for organizational leaders to actively promote and foster a healthy safety culture. Their support for engaging workers in open discussions, decisions and actions on safety ensures an environment of continual safety improvement. Shared space is a critical aspect of safety culture assessments; these assessments depend on the free flow of views and opinions in an environment of trust.

Information on the concept of shared space, an important consideration in undertaking safety culture assessments, can be found in IAEA Safety Report Series 83, Performing Safety Culture Assessments, section 2.3 *Shared Space: Improving Safety Culture Through Healthy Social Interactions* [1, pg12-14]. Additional information on safety culture assessments can be found in section 3.1 *Purpose and Benefits of Safety Culture Assessments* [1, pg15-16].

3.1 Criteria applicable to safety culture assessment methods

Adhering to a set of criteria ensures that safety culture assessments are consistent and subsequent findings are reliable over time. The following criteria apply to safety culture assessment approaches (the overall means) and methods (the specific data collection and analysis tools). Although these are intended for assessments conducted in large organizations, any size or type of licensee may use them to develop, improve and refine safety culture assessments.

Comprehensive

- The assessment approach is used to assess the entire organization, or a range of different job positions, departments, demographics and lines of work.
- The assessment approach covers the range of cultural characteristics/traits being assessed.
- The assessment approach uses a combination of quantitative and qualitative methods in order to build a comprehensive understanding of the licensee's safety culture.

Systematic

- What is to be assessed is clearly described.
- Methods measure what they claim to measure.
- Information obtained from an assessment method is clearly documented to allow traceability throughout the analysis.
- The assessment produces a clear interpretation of the organization's safety culture, based on collected data.
- Actions resulting from the assessment are linked to the analysis and the collected data.

Rigorous

- The methods minimize the chance for bias and unwanted subjectivity throughout the stages of scope setting, training, data collection, analysis, review and reporting.
- The methods are defensible and are described in sufficient detail so that they can be replicated by different individuals and across time.
- The assessment approach yields information that is credible because it is based on collected data.

3.2 Preparing for the safety culture assessment

There are different approaches to conducting a safety culture assessment. It may be conducted independently by an external organization or contractor or as a self-assessment by workers within the organization. A safety culture assessment is generally a hybrid of these two types, using a blended team of external participants and workers who represent all areas of the organization.

Organizations that hire a contractor to conduct the assessment have the advantage of increased objectivity over the course of an assessment. Consideration may be given to ensuring that the experience and insights gained from the assessment are retained within the organization. While self-assessments risk being less objective, they are more adaptable and offer learning and development opportunities for workers.

Additional information can be found in IAEA Safety Report Series 83, Performing Safety Culture Assessments section 3.2 *Special considerations for Safety Culture Self Assessments* [1, pg 17-18].

Safety and security are integrated goals for any nuclear facility. Although safety and security culture assessment methods are generally similar, a security culture assessment places additional emphasis on mitigating the risk (likelihood and consequences) of deliberate malicious acts. As a result, the comprehensive safety culture reference framework (Appendix A) has three indicators specific to security culture: the belief of a credible threat, employee screening practices and ensuring sensitive information is classified and controlled. While safety culture assessments could simultaneously assess security culture, licensees may choose to undertake independent assessments to assess security culture.

3.3 Plan the assessment

Planning the assessment involves applying the chosen assessment method and associated framework, as well as finalizing details of how data will be collected, analyzed, interpreted and reported.

Understanding that safety culture can change over time (Principle #3) will help an organization to maintain and improve safety. A maturity model may be used to describe and interpret the organization’s safety culture, so it can be monitored and improved (see appendix B).

The description of the safety culture assessment’s goals should explain how the assessment supports organizational objectives. An overview of how the safety culture assessment relates to relevant organizational programs and practices (e.g., corrective and preventive action programs, managing human performance, communications) should be included.

The description of the scope can provide a rationale for the organizational areas included in the assessment (e.g., departments, functions, workgroups, on site contractors).

If the current safety culture assessment is not the licensee's first, planning can include reviewing previous safety culture assessments and the resulting improvement plans, to determine how these actions have affected the organization's safety culture.

An overview of the assessment process can be found in IAEA Safety Report Series 83, Performing Safety Culture Assessments sections 4.1 – 4.3, covering *Organizational Readiness*, *Application of Shared Space in Safety Culture Assessments*, and *Process Flow and Steps* [1, pg19-26].

Documents related to the planning phase can include organizational context (size, risks, complexity) considered in determining the breadth and depth of data collection and analysis, as well as an overview of each phase of the assessment including associated timelines.

3.3.1 Assessment team selection

Selection of an appropriate assessment team is essential to ensuring the continual development and improvement of the assessment process and outputs.

The team should be selected to ensure adequate knowledge and expertise of safety culture and the organization's technology. A best practice is to include representatives from another licensee organization or industry on the assessment team. Assessors involved in peer audits have more in-depth industry knowledge, and may also have an advantage relating to interviewees and interpreting data with greater objectivity.

Team members should collectively have knowledge and experience in:

- human factors and behavioural/social sciences
- qualitative and quantitative methods for cultural assessment
- assessments of safety culture
- various functional area specialties (e.g. security, workers both unionized and not unionized as applicable, operations, maintenance, corporate office staff, senior management)
- technologies of the organization

The overall team may reflect a balanced representation of the above, including consideration of worker demographics (age, gender, seniority).

The assessment team lead(s) may be experienced and knowledgeable in safety culture, monitoring of safety culture, and assessment and improvement methods. The team lead's responsibilities may include:

- selecting team members and team member training, if necessary
- determining roles and responsibilities of team members
- planning and coordinating the assessment
- liaising with management and leadership (union, senior workers)
- communicating with the organization
- ensuring the organization is fully engaged in the assessment
- supervising the process of the assessment
- implementing measures to monitor and improve the assessment process where necessary
- producing preliminary and final reports

During the assessment, the team lead(s) may make decisions about all aspects of the assessment plan (e.g., management interfaces/engagement, team member roles and training, effective application of a safety culture framework and method, reporting of results, and transition to actions).

Additional information on team selection can be found in IAEA Safety Report Series 83, Performing Safety Culture Assessments, section 4.4 *Team Composition and Competencies* and section 4,5 *Roles and Responsibilities*[1, pg 27-30].

Documents related to team selection can include rationales of decisions regarding team membership.

3.3.2 Internal communications strategy

Licensees should develop and implement a communications strategy for the assessment, and consider proactively engaging workers and leaders throughout the assessment process. Where possible, safety culture assessments can be integrated with licensees' overall communications strategies to ensure timely and consistent messaging. Licensees can consider the timing and frequency of communications, potential communication vehicles, and how to tailor messaging to specific audiences.

Communication with internal stakeholders may take place throughout the safety culture assessment, and the resulting planning and implementation of improvement initiatives. Senior management should promote organization-wide participation in all aspects of the assessment via surveys, interviews and other assessment tools.

For security culture, the communications plan must consider that some information is security sensitive; however, for the benefit of greater awareness, all aspects can be shared broadly even if this requires some incidents or lessons learned to be generalized.

A communications strategy can, at the various stages of an assessment and follow-up activities, include a summary of the assessment method, findings and improvement plans. The information should be shared with the following internal stakeholders to the extent possible:

- workers
- management
- organizational groups with special functions or requirements (e.g., security, health and safety committees, union representatives, contractors, etc.)

Licensees can expect and encourage feedback from stakeholders. Feedback can provide insight into the culture of the organization, and can be used to refine the communications strategy.

Additional information on communications throughout the assessment process can be found in in IAEA Safety Report Series 83, Performing Safety Culture Assessments section 4.3 *Process Flow and Steps*, and specifically the results of an assessment in section 7.2 *Communicating the Results* [1, pg19-26, 46-47].

Documents related to the communication strategy can include the communications plan. Records related to the communications strategy can include the communications themselves.

3.3.3 Assessment framework

Principle 5 reads “Safety culture assessment and improvement activities are informed by a defined framework of key characteristics known to reflect a healthy culture”. A safety culture framework provides a basis for the systematic review of safety culture against a defined set of characteristics. It also provides a common vocabulary to facilitate communications, and aids in developing improvement plans to address the shared perceptions and attitudes of workers. There are several culture frameworks currently in use across a variety of organizations and licensee contexts.

Licensees should ensure that the safety culture assessment framework is mapped against the five safety culture characteristics (see Appendix A of this document).

3.3.4 Assessment method selection

In determining the assessment method, several factors can be considered, including the organization’s size and complexity, and the risks and consequences associated with the licensed activity. The assessment can address the shared beliefs and attitudes on safety and security – at all levels and functional areas of the organization. Assessments of safety culture may include specific language and data-gathering tools tailored to specific topics and workers.

3.4 Data collection

The primary methods used in safety culture assessments are well established social science tools being document review, surveys, focus groups, interviews and observations. One key area of this work is participant confidentiality. Participant confidentiality is crucial in gaining information from participants in safety culture assessments, and the assessment team should take precautions (e.g. restrict the number of team members who can access the identities and contributions of participants, de-identify the contributions of participants) to assure participants’ information is kept confidential.

Additional information on methods can be found in IAEA Safety Report Series 83, Performing Safety Culture Assessments, all of section 5 *Methods*, which explains the five data collection methods, including their limitations and risks [1, pg 30-37].

3.5 Data analysis

The primary analysis method in safety culture assessments is a thematic analysis. Rather than a linear exercise to compile information to build a case, the analysis is iterative, using parallel streams of information to explore cultural influences. The focus is to analyze the collected data to understand the culture as opposed to exclusively measuring adherence to the framework.

During the assessment, the team may need to refine its scope in order to identify possible patterns that warrant additional attention, data collection and analysis. Emergent themes identified throughout the assessment may lead to supplementary analysis and reflection. The assessment team should periodically review assessment objectives (such as those listed in section 3.1 of this document) to ensure adherence to methodological criteria.

Additional information on analysis can be found in IAEA Safety Report Series 83, Performing Safety Culture Assessments, section 6 *Conducting the Analysis* and section 6.1 *Working with Qualitative and Quantitative data* [1, pg 38].

Documents related to the assessment method and associated safety culture framework may include a discussion of how the data collection and analysis techniques applied are comprehensive, systematic and rigorous.

3.6 Assessment report

An assessment report should provide an overview of results: a summary of the analysis process, including general themes as well as the organization's strengths and opportunities for improvement. Assessment findings may concentrate on one specific area or topic, and should be based on organization-wide data. A description of the data and analysis can be included with each finding. The report can outline the team's findings, including supporting evidence aligned with the selected assessment framework. Any insights that the team can provide on the underlying cause of the findings will help develop the improvement plan.

Additional information on writing the final report can be found in IAEA Safety Report Series 83, Performing Safety Culture Assessments, section 7.1 *Writing the self-assessment report* [1, pg 45-46].

Documents related to summarizing the findings may include the executive summary, a description of the assessment process, and the final assessment report.

3.7 Respond to the assessment and transition to action

Licensees should respond to assessment results by developing and implementing an improvement plan. This can include an analysis of the assessment results and offer opportunities for organizational leaders to reflect on these results. The process of translating assessment findings and insights into actions may be integrated into existing programs and processes, such as problem identification and resolution systems; corrective and preventive action programs; leadership critical reflective conversations about safety culture; safety culture monitoring panels; and other organizational improvement processes.

The improvement plan represents a road map toward the organization's vision of the desired safety culture, and it should contain goals and timelines for achieving them. The licensee may articulate or reaffirm this vision in subsequent communications; the characteristics of a healthy safety culture can help articulate and refine this vision, which may be compared to the current safety culture state based on the assessment. Any gaps will inform management as to where to focus the improvement plan, and identify positive characteristics that should be protected and fostered.

Licensees can prioritize improvements based on assessment results, with consideration to the potential impact to safety and security, trends from previous assessments, and the unique context of their organization and work environment, as well as organization's vision of the desired safety culture. How a licensee chooses improvements following an assessment, and the commitment to implementing these improvements, should be consistent with its management system and lead to improvements.

Additional information on the transition into action can be found in in IAEA Safety Report Series 83, Performing Safety Culture Assessments, section 7.3 *Transition to Action* [1, pg 47-49].

Records on the assessment report and improvement plan may include a discussion of how the assessment findings are integrated with safety culture monitoring activities and the organization's

processes and practices to improve safety. Specific corrective/preventive actions may be described along with the expected results and timelines for implementation.

Appendix A: Safety Culture Reference Framework

This Appendix provides guidance for all licensees.

The following list is a reference framework for demonstrating a commitment to safety, and describes five characteristics of a healthy safety culture. It includes observable and measurable indicators for each safety culture characteristic and can help licensees clearly demonstrate how they foster safety culture in their organization. The framework is adapted from the GS-G-3.5, The Management System for Nuclear Installations [6]; and IAEA Nuclear Security Series No. 7, Nuclear Security Culture [11]. Since healthy safety and security cultures have similar characteristics and indicators, these are consolidated. Indicators that apply only to security culture are marked with an asterisk (*).

Safety is a clearly recognized value

- Resources are allocated as necessary to ensure safety.
- Multiple mechanisms are used to clearly communicate the value of safety in the organization.
- Timely decisions are made that reflect the value and relative priority placed on safety.
- The importance of safety is documented and demonstrated in the operation of the organization.
- The promotion of a healthy safety culture is prevalent throughout all aspects of the management system.
- Workers understand that safety, security, and production are closely linked.
- Workers understand that a credible threat to security exists, and acknowledges that nuclear security is important*.
- There is a sense of urgency to correct significant safety and security weaknesses or vulnerabilities.

Accountability for safety is clear

- There are clearly defined roles and responsibilities for all levels and positions in the organization.
- Workers are held accountable for adherence to established policies and procedures
- Shared safety responsibilities are delegated to individuals and teams with appropriate authority.
- There is a high degree of compliance with, and understanding of, regulatory requirements.
- Complete and accurate information is provided to the CNSC, and other stakeholders as appropriate, in a timely and open manner.
- Workers demonstrate a commitment to safety throughout the organization and an understanding of how they contribute to safety goals.
- Workers understand how their roles and interfaces contribute to maintaining safety and security.

A learning organization is built around safety

- Lessons learned from experiences internal and external to the organization, including successes and challenges, are used as a basis for continual improvement.
- Safety culture assessments, including self-assessments are used to improve performance.
- Processes exist to identify and correct problems in a timely manner, and to develop, implement, and measure the effectiveness of corrective and preventive actions.
- Various training methods are used to maintain and improve professional and technical competence of members of the organization.
- Safety performance indicators are continually developed, tracked, evaluated and acted on.
- Workers are encouraged and recognized for reporting concerns or suspicions, are free from reprisal, and feel that they have been heard when they voice issues.

- A questioning attitude is maintained by all members of the organization to constantly challenge the safety of day-to-day activities.
- There is systematic development of individual competencies.
- There is an appreciation throughout the organization for diversity of opinion.
- Lessons learned are shared with domestic and international partners.

Safety is integrated into all activities in the organization

- Documentation and processes, from planning to implementation and review, are complete and followed in accordance with management system requirements.
- Classification and control measures are implemented to protect sensitive information.*
- Safety performance indicators are continually tracked, trended and evaluated in order to monitor safety; ineffective performance indicators are refined and improved to ensure they continually reflect the health of the licensee's safety culture.
- Documented screening processes match the risks and threats associated with the specific employment roles and responsibilities*.
- Workers have the necessary knowledge of work processes and adhere to them.
- Workers are involved in risk assessment and decision-making processes.
- Workers are empowered to identify and address issues related to safety and security matters.
- There are good housekeeping practices, well maintained materials and equipment, and good working conditions in place.

A safety leadership process exists in the organization

- All workers are involved and motivated in promoting a healthy safety culture.
- Managers are visible and actively involved in both preventive and reactive safety-related activities.
- Change management processes are in place and are followed to achieve orderly transitions.
- Collaboration, mutual respect, safety conscious behaviour and teamwork are encouraged, supported and recognized.
- Commitment to safety is evident at all levels of the organization.
- The impact of informal leaders on safety culture is recognized and leveraged to continually improve safety culture.
- There are clear expectations and policies to support open communications.
- Managers communicate clear expectations for performance in areas that affect safety and security.
- A proactive and long-term approach to safety is demonstrated in decision making.
- Managers do not abuse authority to circumvent safety or security.
- Managers seek continual improvement in security and work to prevent complacency from compromising overall safety and security objectives.

Appendix B: Safety Culture Maturity Model

This appendix provides guidance for all licensees.

Understanding how safety culture changes over time, both positively and negatively, is essential to fostering safety culture. The safety culture maturity model presented here, as well as the associated indicators in Appendix C, have been adapted from the following IAEA publications:

- IAEA-TECDOC No. 1329, *Safety Culture in Nuclear Installations: Guidance for Use in the Enhancement of Safety Culture* [18]
- INSAG-15, *Key Practical Issues in Strengthening Safety Culture* [9]
- Safety Series Report No.11, *Developing Safety Culture in Nuclear Activities – Practical Suggestions to Assist Progress* [10]

Note that specific activities or behaviours within an organization, group or team will often fit into more than one stage depending on the specific indicators used. Organizations, groups, or teams may fluctuate between these stages over time.

The three stage descriptive safety culture maturity model below can be also used to assess security culture maturity, so that it can be monitored and improved.

Stage 1: Requirement-driven

Safety is primarily reactive and driven by formal rules and management direction.

Safety is viewed principally as a technical and procedural issue related to worker safety. Adherence to established rules and externally imposed regulations become the overriding reasons for safety in the performance of work. Procedural violations are understood primarily as individual worker issues as opposed to an outcome of organizational processes. Most workers believe that safety is primarily a responsibility of management or a designated authority, and that safety requirements and procedures are generally imposed upon them by others.

Stage 2: Goal-driven

Good safety performance becomes an organizational objective and is dealt with primarily in terms of safety goals.

There are processes and procedures for achieving safety goals. These processes are grounded in clear organizational objectives, which describe how specific organizational values and goals relate directly to safety. Improvement initiatives are administered and monitored by suitably qualified and experienced persons, while workers have the option to contribute to improvements in safety performance. Safety targets are monitored for effectiveness and strengthened over time, and safety goals are systematically integrated across all areas. It is understood that worker performance depends on effective organizational systems.

Stage 3: Continually improving

Safety is seen as a continually improving and proactive process, beginning with all workers sharing a clear vision of and value for safety.

All workers, including managers and contractors are personally and actively involved in enhancing safety throughout the organization. Everyone has a clear understanding of safety-related requirements and how their own responsibilities contribute to achieving and sustaining enhancements to safety in their everyday

tasks. Complacency towards risks and threats is identified and eliminated through attention to process safety, and all workers share a questioning attitude.

Appendix C: Safety Culture Maturity Model Indicators and Specific Behaviours

This appendix provides information for Class II and Nuclear Substances licensees.

The following table lists indicators and describes specific behaviours related to the three stages of maturity of an organization's safety culture. The sources for this table are explained in the introductory paragraph of Appendix B.

Indicator	Stage 1: Requirement-driven	Stage 2: Goal-driven	Stage 3: Continually improving
Planning	Problems are not anticipated, and the licensee reacts to each problem as it occurs.	The licensee concentrates primarily on day-to-day matters, with limited long-term focus on building value through safety.	The licensee acts strategically with a focus on the longer term as well as awareness of the present. It seeks to anticipate problems and deal with their causes before they happen.
Communication and teamwork	Communication between individuals and departments is poor. Collaboration between departments and functional areas is not encouraged.	Management encourages cross-departmental and cross-functional teams and communication. Senior managers function as a team and coordinate departmental and functional decisions.	Workers recognize and demonstrate the need for collaboration between departments. They receive management support, recognition and resources needed to collaborate.
Response to errors	Most mistakes are hidden by work-arounds. Only mistakes with severe consequences are identified and are blamed on workers for their failure to comply with rules.	Management's approach to mistakes is to put more controls in place via procedures and retraining; blaming workers is less prevalent.	Almost all mistakes are viewed in terms of work process variability. It is more important to the licensee to understand what has happened than to find someone to blame; this understanding is used to modify work processes and reinforce worker perceptions.
Role of management	Management is seen primarily as endorsing the rules, pushing workers, and expecting results.	Management's role is seen as applying management techniques.	Coaching workers to improve safety performance is a part of management's role. Management is accountable for modelling continual safety improvements.
Learning	There is little listening to or learning from safety-related experience inside or outside the organization. A defensive posture is assumed in the face of constructive criticism.	The licensee is somewhat open to learning from other organizations, especially techniques and best practices.	Learning from others both inside and outside the organization is valued; time is made available and devoted to adapting such knowledge to improve safety performance.
Value of safety ("safety-production balance")	Safety is viewed as a required nuisance. Short-term profit or productivity goals are seen as all-important and often take priority over safety.	Safety is thought to imply higher cost and reduced production.	Safety and production are seen as interdependent.

Indicator	Stage 1: Requirement-driven	Stage 2: Goal-driven	Stage 3: Continually improving
Stakeholder relationships	Regulators, suppliers, and contractors are treated cautiously or in an adversarial manner.	The licensee's relationship with regulators, suppliers, and contractors are kept distant rather than close; there is a cautious approach where trust must be earned.	Collaborative relationships are developed between the licensee and regulators, suppliers, customers, and contractors.
Value of diversity	Workers are viewed as "system components" who are defined and valued solely in terms of what they produce. Diversity is seen as a weakness.	Diversity is acknowledged as important, but rarely exploited. Diversity is used intermittently in decision-making.	Workers are respected and valued for their contribution to overall performance and for their knowledge of safety as applied. Diversity in opinions is sought and embraced.
Adherence to processes	There is little or no awareness of work or business processes. Expectations are not put in writing and are often assumed.	There is a growing awareness of the impact of influence of culture in the workplace. It is not understood why added controls do not yield the expected results in safety performance. Expectations are written and adherence is expected.	Workers believe in and follow work processes in the organization, and help managers to oversee them.
Conflict management	Dissenters are punished for their viewpoints. There is an adversarial relationship between management and other workers.	Dissenters are tolerated but not encouraged. Conflict is seen as disturbing, and is discouraged in the name of teamwork.	Questions are encouraged and dissenters' viewpoints are appreciated. Conflict is recognized, and it is addressed by finding mutually beneficial solutions Management and workers have a respectful and supportive relationship.
Systems view	Workers perform in isolation; "not my problem" is commonly heard.	Workers are cognizant of how their role and tasks performed affect the organization.	Workers are fully aware of broader organizational goals and how they contribute to them. Decisions are made in the full context of their safety impact on work or business processes, as well as on departments and overall safety performance.

Indicator	Stage 1: Requirement-driven	Stage 2: Goal-driven	Stage 3: Continually improving
Performance management	Performance incentives are not aligned with safety and security goals. Workers are rewarded for obedience and what they produce and deliver, regardless of long-term consequences.	Individual performance incentives are aligned with attaining safety and security goals. It is important to meet or exceed short term productivity goals; workers are rewarded for exceeding goals, regardless of the long-term results or consequences.	Performance incentives – both individual and collective – are aligned with attaining safety and security goals. Short-term performance is measured and analyzed so that changes can be made to improve long-term performance. The licensee rewards not only those who produce, but also those who support others' work and the achievement of organizational goals, including safety. Workers are also rewarded for improving processes as well as results.
Feedback	Feedback is rarely given.	Feedback is given and improvement is consequently expected, regardless of context.	Feedback is routine and it becomes typical to use it to make improvements.
Training	Training is understood as an imposition and impediment to getting work done.	Training is understood as a necessity.	Training is understood as an investment.

Glossary

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*

REGDOC-3.6 includes terms and definitions used in the *Nuclear Safety and Control Act* (NSCA), the regulations made under NSCA, and CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

learning organization *(organisation axée sur l'apprentissage)*
A work environment where people continually build on their capability to reach their goals, where new and challenging ways of interacting and behaving are encouraged in order to meet future organizational challenges, and where everyone has the opportunity to make sense of their work together.

safety culture assessment *(évaluation de la culture de sûreté)*
A periodic evaluation of safety culture using a defined framework and method for data collection, analysis, interpretation and reporting.

security culture ***(****culture de sécurité)*
The characteristics of the work environment, such as the values, rules, and common understandings that influence workers' perceptions and attitudes about the importance that the organization places on security.

References

1. International Atomic Energy Agency (IAEA), IAEA Safety Report Series No. 83 *Performing Safety Culture Self Assessments*, Vienna, 2016.

2. CSA Group, N286-12, *Management System Requirements for Nuclear Facilities*, Mississauga, 2012.

3. IAEA, IAEA Safety Standards Series No. SF-1, *Fundamental Safety Principles*, Vienna, 2006.

4. IAEA, IAEA Safety Standards Series No. GSR Part 1, *Government, Legal and Regulatory Framework for Safety*, Vienna, 2010.

5. IAEA, IAEA Safety Standards Series No. GSR Part 2, *Leadership and Management for Safety*, Vienna, 2016.

6. IAEA, IAEA Safety Standards Series No. GS-G-3.5, *The Management System for Nuclear Installations*, Vienna, 2009.

7. IAEA, IAEA Safety Standards Series No. NS-G-2.4, *The Operating Organization for Nuclear Power Plants*, Vienna, 2001.

8. IAEA, International Nuclear Safety Group report INSAG-24, *The Interface Between Safety and Security at Nuclear Power Plants*, Vienna, 2010.

9. IAEA, International Nuclear Safety Group report INSAG-15, *Key Practical Issues in Strengthening Safety Culture*, Vienna, 2002.

10. IAEA, IAEA Safety Series Report No.11, *Developing Safety Culture in Nuclear Activities – Practical Suggestions to Assist Progress*, Vienna, 1998.

11. IAEA, IAEA Information Circular 274 Rev. 1 Mod. 1 *Amendment to the Convention on the Physical Protection of Nuclear Material*, Vienna, 2016.

12. IAEA, IAEA Nuclear Security Series No. 7, *Nuclear Security Culture*, Vienna, 2008.

13. IAEA, IAEA-TECDOC No. 1801, *Management of the Interface between Nuclear Safety and Security for Research Reactors*, Vienna, 2016.

14. IAEA, IAEA Nuclear Security Series No. 20, *Objective and Essential Elements of a State's Nuclear Security Regime*, Vienna, 2013.

15. IAEA, IAEA Nuclear Security Series No. 13, *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities* (INFCIRC/225/Revision 5), Vienna, 2011.

16. IAEA, IAEA Nuclear Security Series No. 14, *Nuclear Security Recommendations on Radioactive Material and Associated Facilities*, Vienna, 2011.

17. National Energy Institute NEI 09-07 Revision 1 *Fostering a Healthy Nuclear Safety Culture*, Washington DC, 2014.

18. IAEA, IAEA-TECDOC No. 1329, *Safety Culture in Nuclear Installations: Guidance for Use in the Enhancement of Safety Culture*, Vienna, 2002.

Additional Information

1. Canadian Nuclear Safety Commission, History of Discussion paper DIS-12-07, *Safety Culture for Nuclear Licensees*, Ottawa, 2013.

2. International Atomic Energy Agency (IAEA), IAEA-TECDOC No. 1707, *Regulatory Oversight of Safety Culture in Nuclear Installations*, Vienna, 2013.

3. IAEA, (draft) technical guidance, *Enhancing nuclear security in organisations associated with nuclear and/or radioactive material.*

4. World Association of Nuclear Operators, PL 2013-1, *Traits of a Healthy Nuclear Safety Culture*, London, 2013.

5. Nuclear Quality Standard Association, NSQ-100 Guidelines: Section B – Safety Culture, 2016.

6. IAEA, IAEA Nuclear Security Series technical guidance No. 28-T, *Self-Assessment of Nuclear Security Culture in Facilities and Activities*, Vienna, 2017.

CNSC Regulatory Document Series

Facilities and activities within the nuclear sector in Canada are regulated by the Canadian Nuclear Safety Commission (CNSC). In addition to the *Nuclear Safety and Control Act* and associated regulations, these facilities and activities may also be required to comply with other regulatory instruments such as regulatory documents or standards.

Effective April 2013, the CNSC's catalogue of existing and planned regulatory documents has been organized under three key categories and twenty-five series, as set out below. Regulatory documents produced by the CNSC fall under one of the following series:

1.0 Regulated facilities and activities Series

1.1 Reactor facilities
1.2 Class IB facilities
1.3 Uranium mines and mills
1.4 Class II facilities
1.5 Certification of prescribed equipment
1.6 Nuclear substances and radiation devices

2.0 Safety and control areas Series

2.1 Management system
2.2 Human performance management
2.3 Operating performance
2.4 Safety analysis
2.5 Physical design
2.6 Fitness for service
2.7 Radiation protection
2.8 Conventional health and safety
2.9 Environmental protection
2.10 Emergency management and fire protection
2.11 Waste management
2.12 Security
2.13 Safeguards and non-proliferation
2.14 Packaging and transport

3.0 Other regulatory areas Series

3.1 Reporting requirements
3.2 Public and Aboriginal engagement
3.3 Financial guarantees
3.4 Commission proceedings
3.5 CNSC processes and practices

Note: The regulatory document series may be adjusted periodically by the CNSC. Each regulatory document series listed above may contain multiple regulatory documents. For the latest list of regulatory documents, visit the CNSC's website.

L'organisme de réglementation nucléaire du Canada

Système de gestion : **Culture de sûreté**

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Préface

Ce document d'application de la réglementation fait partie de la série de documents d'application de la réglementation de la CCSN intitulée Système de gestion. La liste complète des séries figure à la fin de ce document et elle peut être consultée à partir du site Web de la CCSN.

L'expérience acquise au sein du secteur nucléaire international et d'autres industries au cours des dernières décennies a démontré l'importance d'avoir une saine culture de sûreté pour le maintien de la sécurité des travailleurs, du public et de l'environnement. Une organisation qui encourage activement une saine culture de sûreté peut avoir une forte influence sur les attitudes et les comportements de ses employés et donc sur leur rendement, ainsi que sur le rendement de l'organisation au chapitre de la sûreté.

Le document d'application de la réglementation REGDOC-2.1.2, *Culture de sûreté*, énonce les exigences et l'orientation visant à favoriser une saine culture de sûreté et à mener des évaluations de la culture de sûreté. Il en va de même pour la culture de sécurité. Il est important de reconnaître que la sécurité et la sûreté nucléaires de même que leurs cultures ont le même objectif général, soit de limiter les risques associés aux substances nucléaires et aux installations connexes. Les deux cultures coexistent et se renforcent.

Le REGDOC-2.1.2 se veut un élément du fondement d'autorisation d'une installation ou d'une activité réglementée relevant du champ d'application du présent document. Il sera intégré soit aux conditions et aux mesures de sûreté et de réglementation d'un permis, soit aux mesures de sûreté et de réglementation décrites dans la demande de permis et les documents soumis à l'appui de cette demande.

Pour les nouvelles installations proposées : Le présent document servira à évaluer les nouvelles demandes de permis pour des installations nucléaires de catégorie I et de mines et usines de concentration d'uranium.

L'orientation contenue dans ce document vise à informer le demandeur, à expliquer plus en détail des exigences ou à fournir des précisions aux demandeurs et aux titulaires de permis sur la façon de répondre aux exigences. Il précise aussi comment le personnel de la CCSN évalue des problèmes particuliers ou des données pendant l'examen des demandes de permis. Il est attendu que les titulaires de permis suivent l'orientation contenue dans ce document. Dans le cas où d'autres approches sont adoptées, les titulaires de permis doivent démontrer que celles-ci répondent aux exigences réglementaires.

Pour les installations existantes : Les exigences contenues dans ce document ne s'appliquent que si elles ont été incluses, en totalité ou en partie, dans le permis ou le fondement d'autorisation.

Il est possible de définir et d'utiliser une méthode graduelle, proportionnée au risque, lorsqu'on applique les exigences et l'orientation énoncées dans ce document d'application de la réglementation. L'utilisation d'une méthode graduelle ne constitue pas un assouplissement des exigences. Avec la méthode graduelle, l'application des exigences est proportionnée aux risques et aux caractéristiques particulières de l'installation ou de l'activité.

Le demandeur ou le titulaire de permis peut soumettre un dossier démontrant que l'intention d'une exigence est prise en compte par d'autres moyens et démontrée à l'aide de preuves justificatives.

Remarque importante : Ce document fait partie du fondement d'autorisation d'une installation ou d'une activité réglementée si on s'y réfère directement ou indirectement dans le permis (notamment dans des documents cités en référence du titulaire de permis).

Le fondement d'autorisation établit les conditions limites du rendement acceptable pour une installation ou une activité réglementée et établit les bases du programme de conformité de la CCSN à l'égard de cette installation ou activité réglementée.

Dans le cas où le document est un élément du fondement d'autorisation, le terme « doit » est employé pour exprimer une exigence à laquelle le titulaire ou le demandeur de permis doit se conformer; le terme « devrait » dénote une orientation ou une mesure conseillée; le terme « pourrait » exprime une option ou une mesure conseillée ou acceptable dans les limites de ce document d'application de la réglementation; et le terme « peut » exprime une possibilité ou une capacité.

Aucune information contenue dans le présent document ne doit être interprétée comme libérant le titulaire de permis de toute autre exigence pertinente. Le titulaire de permis a la responsabilité de prendre connaissance de tous les règlements et de toutes les conditions de permis applicables et d'y adhérer.

Table des matières

Culture de sûreté

1. Introduction

La présente section fournit de l'information pour tous les titulaires de permis.

Une saine culture de sûreté est un facteur clé pour réduire la probabilité que des événements liés à la sûreté se produisent et pour atténuer leurs répercussions potentielles ainsi que pour améliorer le rendement en matière de sûreté. Les travailleurs de tous les niveaux, y compris les cadres, ont la responsabilité commune de veiller à ce qu'une saine culture de sûreté soit une priorité.

Le terme « culture de sûreté » a été normalisé dans de nombreuses industries autres que l'industrie nucléaire. Bien qu'elle reconnaisse qu'il existe bon nombre de définitions de la culture de sûreté, la CCSN la définit comme étant les caractéristiques de l'environnement de travail, notamment les valeurs, les règles et la compréhension commune qui influent sur les perceptions et les attitudes des employés à l'égard de l'importance que l'organisation accorde à la sûreté. Cette définition s'harmonise à plusieurs autres utilisées au sein de l'industrie nucléaire, qui comporte des éléments et des objectifs généraux communs. Toutefois, l'approche se veut holistique et ne vise pas uniquement la santé et la sécurité au travail.

L'approche adoptée dans le présent document d'application de la réglementation repose sur les principes suivants :

Principe 1 : Chaque organisation possède une culture de sûreté.
Principe 2 : La culture de sûreté est influencée par des facteurs externes et internes, notamment par tous les travailleurs.
Principe 3 : La culture de sûreté est complexe et évolue au fil du temps.
Principe 4 : Il faut évaluer et surveiller la culture de sûreté pour être en mesure d'atteindre l'objectif commun qui consiste à comprendre la culture de sûreté de l'organisation et à limiter les risques.
Principe 5 : Les activités d'évaluation et d'amélioration de la culture de sûreté reposent sur un cadre défini énonçant des caractéristiques clés connues pour refléter une culture saine.

Plutôt qu'un programme à gérer, une saine culture de sûreté est une interprétation de la façon dont la sûreté est intégrée dans le travail quotidien et les interactions. Elle est renforcée par la façon dont les gens, y compris les cadres, travaillent ensemble pour avoir une compréhension plus approfondie de la culture et de son incidence sur la sûreté. La surveillance en vue de comprendre la culture de sûreté constitue le fondement de la mise en œuvre d'améliorations systémiques de la sûreté au fil du temps. La surveillance peut comprendre plusieurs méthodes, des simples observations et interactions en milieu de travail jusqu'aux évaluations exhaustives de la culture de sûreté dans les organisations de grande taille. Une culture de sûreté parvenue à maturité et faisant l'objet d'une amélioration continue se manifeste dans le cadre des discussions, décisions et mesures quotidiennes liées à la sûreté. Le rapport n^{o} 83 de la Collection Rapports de sûreté de l'AIEA, *Performing Safety Culture Assessments*, section 2.1, « Understanding Culture, Organizational Culture and Safety Culture » [1], comporte des renseignements additionnels favorisant la compréhension de la culture de sûreté.

La CCSN définit la culture de sécurité comme étant les caractéristiques de l'environnement de travail, notamment les valeurs, les règles et la compréhension commune, qui influent sur les

perceptions et les attitudes des employés à l'égard de l'importance que l'organisation accorde à la sécurité.

La culture de sûreté et la culture de sécurité coexistent grâce à l'objectif commun de limitation des risques. Elles ont en commun des objectifs et des techniques concernant les activités de promotion et de surveillance. Dans le présent document, « culture de sûreté » désigne collectivement la culture de sûreté et la culture de sécurité, sauf lorsqu'une distinction est expressément formulée.

Il est donc essentiel pour tous les titulaires de permis de favoriser une saine culture de sûreté au sein de leurs organisations.

1.1 Objet

Le présent document d'application de la réglementation énonce les exigences et l'orientation concernant la promotion et l'évaluation de la culture de sûreté.

1.2 Portée

Le présent document expose les exigences et l'orientation à l'intention des titulaires de permis d'installations de catégorie I et de mines et usines de concentration d'uranium. Il comprend aussi des renseignements utiles pour tous les titulaires de permis; on encourage ces derniers à se servir du présent document pour en apprendre davantage sur la culture de sûreté de leurs organisations. Le document expose des exigences et de l'orientation plus détaillées en ce qui concerne la culture de sûreté, en vue de compléter et de préciser les exigences visant le système de gestion contenues dans la norme N286, *Exigences relatives au système de gestion des installations nucléaires* [2] du Groupe CSA.

Les centrales nucléaires sont assujetties aux exigences des sections 2 et 3; pour ces installations, on recommande d'utiliser les renseignements et l'orientation fournis aux sections 1, 2 et 3 ainsi qu'aux annexes A et B.

D'autres installations nucléaires de catégorie I et mines et usines de concentration d'uranium sont assujetties aux exigences de la section 2; pour ces installations, on recommande d'utiliser les renseignements et l'orientation fournis aux sections 1, 2 et 3 ainsi qu'aux annexes A et B.

Les titulaires de permis d'installations nucléaires de catégorie II et de substances nucléaires ne sont pas assujettis à des exigences officielles, mais on leur recommande de se reporter à l'annexe C ainsi qu'aux renseignements fournis aux sections 1, 2 et 3.

1.3 Législation pertinente

Les dispositions suivantes des règlements pris en vertu de la *Loi sur la sûreté et la réglementation nucléaires* s'appliquent au présent document :

- L'alinéa 3(1)e) du *Règlement général sur la sûreté et la réglementation nucléaires* (RGSRN) prévoit qu'une demande de permis comprend « les mesures proposées pour assurer la conformité au *Règlement sur la radioprotection*, au *Règlement sur la sécurité nucléaire* et au *Règlement sur l'emballage et le transport des substances nucléaires (2015)* ».
- L'alinéa 3(1)k) du RGSRN indique ce qui suit : « La demande de permis comprend les renseignements suivants : […]

k) la structure de gestion du demandeur dans la mesure où elle peut influer sur l'observation de la Loi et de ses règlements, y compris la répartition interne des fonctions, des responsabilités et des pouvoirs; ».

- Aux termes des alinéas 12(1)a), b), c), f) et j) du RGSRN, « le titulaire de permis :
  a) veille à ce qu'il y ait suffisamment de travailleurs qualifiés pour exercer l'activité autorisée en toute sécurité et conformément à la Loi, à ses règlements et au permis;
  b) forme les travailleurs pour qu'ils exercent l'activité autorisée conformément à la Loi, à ses règlements et au permis;
  c) prend toutes les précautions raisonnables pour protéger l'environnement, préserver la santé et la sécurité des personnes et maintenir la sécurité des installations nucléaires et des substances nucléaires; [...]
  f) prend toutes les précautions raisonnables pour contrôler le rejet de substances nucléaires radioactives ou de substances dangereuses que l'activité autorisée peut entraîner là où elle est exercée et dans l'environnement; [...]
  j) donne aux travailleurs de la formation sur le programme de sécurité matérielle sur les lieux de l'activité autorisée et sur leurs obligations aux termes du programme; ».
- Les alinéas 17b), c) et e) du RGSRN prévoient ce qui suit : « Le travailleur : [...]
  b) se conforme aux mesures prévues par le titulaire de permis pour protéger l'environnement, préserver la santé et la sécurité des personnes, maintenir la sécurité et contrôler les niveaux et les doses de rayonnement, ainsi que le rejet de substances nucléaires radioactives et de substances dangereuses dans l'environnement;
  c) signale sans délai à son supérieur ou au titulaire de permis toute situation où, à son avis, il pourrait y avoir :
  (i) une augmentation considérable du niveau de risque pour l'environnement ou pour la santé et la sécurité des personnes, [...]
  e) prend toutes les précautions raisonnables pour veiller à sa propre sécurité et à celle des personnes se trouvant sur les lieux de l'activité autorisée, à la protection de l'environnement et du public ainsi qu'au maintien de la sécurité des installations nucléaires et des substances nucléaires. »
- Les alinéas 21(1)a), b), c), d), e) du RGSRN stipule que « Pour l'application de la Loi, sont désignés comme renseignements réglementés les renseignements qui portent sur ce qui suit, y compris les documents sur ces renseignements :
  a) les substances nucléaires, y compris leurs propriétés, qui sont nécessaires à la conception, la production, l'utilisation, le fonctionnement ou l'entretien des armes nucléaires ou des engins explosifs nucléaires;
  b) la conception, la production, l'utilisation, le fonctionnement ou l'entretien des armes nucléaires ou des engins explosifs nucléaires;
  c) les arrangements, l'équipement, les systèmes et les procédures en matière de sécurité que le titulaire de permis a mis en place conformément à la Loi, à ses règlements ou au permis, y compris tout incident relatif à la sécurité;
  d) l'itinéraire ou le calendrier de transport des matières nucléaires de catégorie I, II ou III au sens de l'article 1 du *Règlement sur la sécurité nucléaire*. »
- Aux termes du sous-alinéa 4a)(i) du *Règlement sur la radioprotection*, « le titulaire de permis met en œuvre un programme de radioprotection et, dans le cadre de ce programme :
  a) maintient le degré d'exposition aux produits de filiation du radon ainsi que la dose efficace et la dose équivalente qui sont reçues par la personne, et engagées à son égard, au niveau le plus bas qu'il soit raisonnablement possible d'atteindre, compte tenu des facteurs économiques et sociaux, par :
  (i) la maîtrise des méthodes de travail par la direction, [...] »

- Le paragraphe 1(1) du *Règlement sur le contrôle de l'importation et de l'exportation aux fins de la non-prolifération nucléaire* (RCIENPN) définit divers termes, notamment les suivants :
  équipement nucléaire contrôlé signifie tout équipement nucléaire contrôlé et ses pièces et ses composants mentionnés à l'annexe
  renseignement nucléaire réglementé signifie tout renseignement nucléaire contrôlé mentionné à l'annexe
  substance nucléaire contrôlée signifie toute substance nucléaire contrôlée mentionnée à l'annexe
  transit signifie le transport via le Canada après l'importation et avant l'exportation, lorsque le point de chargement initial et la destination finale sont à l'étranger
- Les paragraphes (2), (3) et (4) du RCIENPN stipulent que :
  (2) Les substances nucléaires contrôlées sont désignées substances nucléaires pour l'application de l'alinéa d) de la définition de substance nucléaire à l'article 2 de la Loi, en ce qui concerne leur importation et leur exportation.
  (3) L'équipement nucléaire contrôlé est désigné équipement réglementé pour l'application de la Loi, en ce qui concerne son importation et son exportation.
  (4) Les renseignements nucléaires contrôlés sont désignés renseignements réglementés pour l'application de la Loi, en ce qui concerne leur importation et leur exportation, à moins qu'ils soient rendus publics conformément à la Loi, à ses règlements ou à un permis.
- Le paragraphe 1(1) du *Règlement sur la sécurité nucléaire* (RSN) définit divers termes, notamment les suivants :
  mesure de protection physique signifie un élément ou combinaison d'éléments en place dans une installation nucléaire et visant à assurer la protection de celle-ci — ou celle des substances nucléaires qui s'y trouvent — contre les agresseurs potentiels
  système de protection physique signifie l'ensemble des mesures de protection physique dans une installation nucléaire
  évaluation de la menace et du risque signifie une évaluation visant à déterminer la qualité du système de protection physique – existant ou proposé – dans un site à sécurité élevée, du point de vue :
  a) de son efficacité à prévenir tout acte intentionnel qui pourrait constituer une menace pour la sécurité du site;
  b) des faiblesses qu'il pourrait comporter et dont on pourrait tirer partie.
- Les alinéas 3 (c) (f) et (g) du RSN stipule que :
  3) La demande de permis visant une matière nucléaire de catégorie I ou II, autre qu'un permis de transport, et la demande de permis relatif à une installation nucléaire visée à l'alinéa 2b) comprennent les renseignements suivants […] :
  c) une description de l'équipement, des systèmes et des procédures de sécurité proposés;
  f) le plan et les procédures proposés pour évaluer les manquements à la sécurité et y donner suite;
  g) l'évaluation de la menace et du risque à jour.
- L'alinéa 3 du *Règlement sur les installations nucléaires de catégorie I* stipule que « La demande de permis visant une installation nucléaire de catégorie I, autre qu'un permis d'abandon, comprend les renseignements suivants…
  d) le système de gestion proposé pour l'activité visée, y compris les mesures qui seront prises pour promouvoir une culture de sûreté et l'appuyer. »
- L'alinéa 3 du *Règlement sur les mines et les usines de concentration d'uranium* stipule que « La demande de permis visant une mine ou une usine de concentration d'uranium, autre que le permis d'abandon, comprend les renseignements suivants…
  (b) à l'égard de l'activité visée par la demande…

v) le système de gestion proposé pour l'activité, y compris les mesures qui seront prises pour promouvoir une culture de sûreté et l'appuyer. »

1.4 Normes nationales et internationales applicables

L'Agence internationale de l'énergie atomique (AIEA) a affirmé qu'il est nécessaire que les organismes de réglementation et les titulaires de permis instaurent une culture de sûreté. Le cadre de promotion de la culture de sûreté de l'AIEA est intégré dans plusieurs normes et guides de sûreté. La culture de sûreté est mise en évidence dans la Collection Normes de sûreté de l'AIEA n° SF-1, *Principes fondamentaux de sûreté* [3]. Cette publication expose des principes relatifs à la responsabilité première des titulaires de permis en matière de sûreté, à l'intégration de la culture de sûreté dans le système de gestion et à la prévention des accidents par le recours à la défense en profondeur (principes 1, 3 et 8, respectivement, de la norme SF-1). La norme SF-1 souligne également l'importance d'une intégration de la sûreté et de la sécurité.

Les principes et éléments clés utilisés lors de l'élaboration du présent document sont conformes aux prescriptions de la norme SF-1 de même qu'aux normes, aux directives et aux pratiques nationales et internationales. En particulier, le présent document vient compléter les publications suivantes :

- norme N286-F12, *Exigences relatives au système de gestion des installations nucléaires* du Groupe CSA [2]
- les documents suivants de l'AIEA :
  - Collection Rapports de sûreté de l'AIEA n° 83, *Performing Safety Culture Self Assessments* [1]
  - GSR Partie 1, *Cadre gouvernemental, législatif et réglementaire de la sûreté* [4]
  - GSR Partie 2, *Leadership and Management for Safety* [5]
  - GS-G-3.5, *The Management System for Nuclear Installations* [6]
  - NS-G-2.4, *L'organisme exploitant des centrales nucléaires* [7]
  - INSAG-24, *The Interface Between Safety and Security at Nuclear Power Plants* [8]
  - INSAG-15, *Key Practical Issues in Strengthening Safety Culture* [9]
  - Collection Rapports de sûreté n° 11, *Developing Safety Culture In Nuclear Activities* [10]

1.4.1 Culture de sécurité

Le Canada a signé la version modifiée de la *Convention sur la protection physique des matières nucléaires* [11], qui oblige ses États membres à appliquer tous les principes fondamentaux qui y sont établis. L'un de ces principes vise la culture de sécurité.

> Principe fondamental F : *Culture de sécurité*
> Toutes les entités impliquées dans la mise en œuvre de la protection physique devraient accorder la priorité requise à la culture de sécurité, à son développement et à son maintien, nécessaires pour assurer sa mise en œuvre effective à tous les échelons de chacune de ces entités [11, p.5].

Dans la publication de la Collection Sécurité nucléaire n° 7, *Culture de sécurité nucléaire* [12], l'AIEA fait état de la nécessité pour les titulaires de permis, les organismes de réglementation et les États d'instaurer une culture efficace de sécurité nucléaire. Cela offrira une garantie supplémentaire pour empêcher, détecter et retarder un vol, un sabotage, un accès non autorisé, un transfert illégal ou d'autres actes malveillants mettant en jeu des substances nucléaires et de l'équipement ou des renseignements réglementés lors de leur utilisation, de leur stockage ou de leur transport, et pour intervenir lorsque de tels actes sont commis.

Tel qu'il est susmentionné, la culture de sécurité et la culture de sûreté coexistent et se renforcent mutuellement. Une analyse des caractéristiques et des indicateurs des deux cultures permet de démontrer leur harmonisation générale. Les différences sont peu nombreuses, et les deux cultures pourraient n'en former qu'une seule sans qu'il ne soit nécessaire d'apporter des changements considérables sur le plan des mesures physiques et des processus qui visent actuellement à renforcer la culture de sûreté.

L'approche concertée visant à combiner ces cultures dans un cadre ou une politique devrait mener à des activités qui se soutiennent mutuellement, qui favorisent et qui renforcent une culture inclusive tout en réduisant le dédoublement des efforts. Une approche visant à intégrer ces cultures permet de mettre en place un processus efficace et efficient qui diminue le besoin global de ressources et qui favorise une approche plus exhaustive et cohérente envers le renforcement de la culture. La mise en commun des expériences et des connaissances opérationnelles des méthodes de développement et de renforcement de la culture de sûreté pourrait faciliter l'amélioration et la promotion des caractéristiques et des traits d'un modèle de culture existant et mature.

En outre, le présent document repose en partie sur les publications suivantes :

- AIEA-TECDOC n° 1801, *Management of the Interface between Nuclear Safety and Security for Research Reactors* [13]
- Collection Sécurité nucléaire de l'AIEA n° 20, *Objectif et éléments essentiels du régime de sécurité nucléaire d'un État* [14]
- Collection Sécurité nucléaire de l'AIEA n° 13, *Recommandations de sécurité nucléaire sur la protection physique des matières nucléaires et des installations nucléaires* (INFCIRC/225/Révision 5) [15]
- Collection Sécurité nucléaire de l'AIEA n° 14, *Recommandations de sécurité nucléaire relatives aux matières radioactives et aux installations associées* [16]

2. Promotion d'une culture de sûreté

La présente section énonce les exigences et l'orientation applicables à toutes les installations nucléaires de catégorie I et les mines et usines de concentration d'uranium.

Dans leurs documents de gouvernance, les titulaires de permis doivent s'engager à promouvoir une culture de sûreté.

La présente section fournit de l'information à l'intention de tous les autres titulaires de permis.

Orientation

2.1 Documents de gouvernance de la culture de sûreté

Selon le Principe 1, chaque organisation possède une culture de sûreté qui devrait être reflétée dans ses documents de gouvernance. Les titulaires de permis ont la responsabilité de promouvoir une saine culture de sûreté, en favorisant et en renforçant un engagement pris collectivement à l'égard de la sûreté qui tienne adéquatement compte des risques et de la complexité des activités autorisées. À cette fin, les titulaires de permis devraient utiliser tous les moyens disponibles, notamment en s'appuyant sur leurs documents de gouvernance (par exemple, politiques,

processus, procédures et manuels) pour définir et gérer les objectifs de sûreté et de rendement. Cela met en contexte les exigences relatives à la culture de sûreté établie dans la norme N286, *Exigences relatives au système de gestion des installations nucléaires* du Groupe CSA [2].

À leur niveau le plus élevé, les documents de gouvernance devraient attester que la sûreté constitue la priorité absolue, qu'elle l'emporte sur les exigences relatives à la production et au calendrier d'exécution des projets et qu'elle forme la base de la promotion d'une saine culture de sûreté, celle-ci incluant une attitude de questionnement et un engagement à l'égard de l'excellence dans la réalisation de toutes les activités importantes du point de vue de la sûreté. Les documents de gouvernance peuvent décrire le ou les rôles de leadership qui englobent les niveaux de responsabilité les plus élevés pour ce qui est des questions de sûreté ainsi que les domaines dans lesquels les travailleurs ont une responsabilité commune en matière de sûreté. Les responsables peuvent se servir des documents de gouvernance pour montrer aux travailleurs les comportements clés de sûreté à adopter et veiller à ce que tous les membres du personnel comprennent leurs responsabilités assignées ainsi que leurs objectifs de rendement en matière de sûreté. La promotion et le renforcement d'un engagement collectif envers la sûreté englobent l'amélioration continue et l'application concrète de tous les documents de gouvernance.

2.2 Surveillance continue de la culture de sûreté

Selon le Principe 4, il faut évaluer et surveiller la culture de sûreté en vue d'atteindre l'objectif commun visant à comprendre la culture de sûreté de l'organisation et à limiter les risques. Une surveillance continue est essentielle pour favoriser une saine culture de sûreté. La surveillance de la culture de sûreté permet à la direction de comprendre comment la sûreté transparaît quotidiennement dans les discussions, les décisions et les mesures prises. Les titulaires de permis sont dotés de nombreux processus et activités, dont certains sont énoncés ci-dessous, qui leur permettent de s'informer sur la culture de sûreté. Ces processus et activités doivent être périodiquement examinés, par l'intermédiaire des processus d'examen de la direction du titulaire de permis, du point de vue de la culture de sûreté, afin d'accroître la sensibilisation de l'organisation à la culture de sûreté. Si les activités de surveillance permettent de déceler des possibilités d'amélioration, on devrait envisager de classer ces améliorations par ordre de priorité et de les mettre en œuvre.

Voici des exemples de sources de données permettant de surveiller la culture de sûreté aux fins de discussion et d'analyse :

- des sondages, notamment les sondages thématiques, les sondages auprès des travailleurs dans des secteurs ciblés et les sondages de suivi
- des groupes de réflexion, des séances de discussion ouverte ou des outils de rétroaction liés à la sûreté
- des occasions offertes aux travailleurs de discuter de leurs rôles et responsabilités personnels en matière de sûreté et d'y réfléchir
- la sollicitation d'une rétroaction sur des domaines d'intérêt précis auprès des travailleurs, de la direction, des organismes de réglementation, des entrepreneurs ou des parties intéressées
- la détermination des tendances et l'analyse des principaux indicateurs de rendement de l'organisation et d'autres vérifications et évaluations organisationnelles
- la détermination des tendances et l'analyse des indicateurs de rendement opérationnel décelés dans le cadre des activités de surveillance courantes
- la réflexion sur les dialogues officiels et non officiels axés sur la sûreté entre les membres de la direction et les autres travailleurs

- les occasions possibles d'apporter des changements à la culture de sûreté à la suite d'importantes transformations organisationnelles, par exemple une nouvelle administration, ou un changement de structure ou de responsabilités
- le signalement des accidents évités de justesse, des événements ou des incidents ainsi que les interventions subséquentes

Pour obtenir des renseignements additionnels sur la surveillance continue de la culture de sûreté, consulter le document NEI 09-07, Révision 1, *Fostering a Healthy Nuclear Safety Culture* [17].

Pour les titulaires de permis qui entreprennent des évaluations de la culture de sûreté, la surveillance continue constitue une méthode complémentaire de surveillance de la santé de la culture de sûreté entre les évaluations. Par exemple, ces activités de surveillance peuvent alimenter les évaluations ultérieures, notamment en relevant les tendances sur le plan des indicateurs par rapport aux évaluations antérieures. De plus, les renseignements tirés des activités de surveillance peuvent être analysés et interprétés dans le contexte des résultats de l'évaluation. Par exemple, les constatations d'évaluations antérieures peuvent souligner la pertinence de nouvelles activités de surveillance ou permettre de perfectionner des activités existantes.

Le modèle de maturité de la culture de sûreté en trois étapes décrit à l'annexe B constitue un outil pratique pour établir initialement la maturité de la culture de sûreté et pour surveiller les changements survenant au fil du temps. On peut procéder au suivi de l'évolution de la culture de sûreté au moyen de documents adéquats.

3. Évaluations de la culture de sûreté

La présente section établit les exigences et l'orientation applicables aux centrales nucléaires.

Les titulaires de permis mèneront au moins tous les cinq ans, des évaluations exhaustives, systématiques et rigoureuses de la culture de sûreté.

La présente section fournit de l'information à l'intention de tous les autres titulaires de permis.

Orientation

Une évaluation de la culture de sûreté consiste à recueillir, à examiner et à analyser systématiquement les données pertinentes en matière de culture ainsi qu'à définir et à prendre des mesures d'amélioration. Elle a pour objet de promouvoir la sûreté, de recueillir des informations sur les facteurs organisationnels qui influent sur la sûreté et de chercher constamment à comprendre comment la culture se concrétise au sein de l'organisation.

Selon le Principe 2, la culture de sûreté est influencée par des facteurs externes et internes, notamment par tous les travailleurs. Les organisations qui mènent des activités complexes, reposant sur la participation de nombreux travailleurs et sur de multiples processus interdépendants, peuvent tirer profit des évaluations de la culture de sûreté.

Selon le Principe 3, la culture de sûreté est complexe et évolue au fil du temps. Des changements au sein de l'organisation peuvent avoir un impact sur elle; des évaluations devraient être

effectuées selon les besoins opérationnels (nouvelles administration, gouvernance, structure, responsabilités ou activités, comme la remise en état ou le déclassement).

Une évaluation de la culture de sûreté donne aux dirigeants de l'organisation l'occasion de promouvoir et de favoriser activement une saine culture de sûreté. En appuyant la participation des travailleurs à des discussions ouvertes, aux décisions et aux mesures en matière de sûreté, les dirigeants assurent l'instauration d'un climat d'amélioration continue de la sûreté. Les espaces communs constituent un aspect essentiel des évaluations de la culture de sûreté; ces dernières dépendent de la capacité à exprimer librement son opinion dans un environnement qui favorise la confiance.

Le rapport n^{o} 83 de la Collection Rapports de sûreté de l'AIEA, *Performing Safety Culture Assessments*, section 2.3, « Shared Space : Improving Safety Culture Through Healthy Social Interactions » [1, p. 12-14], comprend des renseignements additionnels sur le concept des espaces communs, qui constitue un facteur important de la réalisation des évaluations de la culture de sûreté. Pour obtenir des renseignements additionnels sur les évaluations de la culture de sûreté, voir la section 3,1 « Purpose and Benefits of Safety Culture Assessments » [1, p. 15-16].

3.1 Critères applicables aux méthodes d'évaluation de la culture de sûreté

Le respect d'un ensemble de critères fait en sorte que les évaluations de la culture de sûreté sont cohérentes et que les conclusions qui en découlent sont fiables au fil du temps. Les critères suivants s'appliquent aux approches (les moyens généraux) et aux méthodes (la collecte de données précises et les outils d'analyse) d'évaluation de la culture de sûreté. Même si ces critères sont conçus pour les évaluations menées dans de grandes organisations, les titulaires de permis de toutes tailles et de tous types peuvent s'en servir pour élaborer, améliorer et peaufiner leurs méthodes d'évaluation.

Exhaustive

- L'approche d'évaluation est utilisée pour évaluer l'ensemble de l'organisation ou un éventail de postes, de services, de caractéristiques démographiques et de secteurs d'activité différents.
- L'approche d'évaluation couvre toute la gamme des caractéristiques et des traits culturels devant être évalués.
- L'approche d'évaluation fait appel à une combinaison de méthodes quantitatives et qualitatives en vue de bien comprendre l'ensemble la culture de sûreté du titulaire de permis.

Systématique

- Ce qui doit être évalué est clairement décrit.
- Les méthodes mesurent ce qu'elles sont censées mesurer.
- Les renseignements obtenus au moyen d'une méthode d'évaluation sont documentés avec clarté afin de permettre d'en trouver la source tout au long de l'analyse.
- L'évaluation permet une interprétation claire de la culture de sûreté de l'organisation, à partir des données recueillies.
- Les mesures découlant de l'évaluation s'inscrivent dans le cadre de l'analyse et des données recueillies.

Rigoureuse

- Les méthodes permettent de minimiser la possibilité qu'il y ait des idées préconçues et la subjectivité non voulue à toutes les étapes de la détermination de la portée, de la formation, de la collecte de données, de l'analyse, de l'examen et de l'établissement de rapports.

- Les méthodes sont justifiables et sont suffisamment détaillées pour être reproduites par différentes personnes à divers moments.
- L'approche d'évaluation permet d'obtenir des renseignements crédibles, car elle est fondée sur les données recueillies.

3.2 Préparatifs de l'évaluation de la culture de sûreté

Il existe différentes démarches possibles pour procéder à une évaluation de la culture de sûreté. Cette évaluation peut être effectuée de façon indépendante par une organisation ou un entrepreneur externe, ou sous forme d'autoévaluation par les travailleurs au sein de l'organisation. En général, on a recours à une combinaison d'éléments des deux types, soit une équipe de participants externes et des travailleurs qui représentent tous les secteurs de l'organisation.

Les organisations qui embauchent un entrepreneur pour procéder à l'évaluation ont l'avantage d'une objectivité accrue tout au long du processus. On peut veiller à ce que l'expérience et les leçons issues de l'évaluation soient conservées au sein de l'organisation. Même si les autoévaluations risquent d'être moins objectives, elles sont plus faciles à adapter et elles offrent des possibilités d'apprentissage et de perfectionnement aux travailleurs.

Le rapport n^{o} 83 de la Collection Rapports de sûreté de l'AIEA, *Performing Safety Culture Assessments*, section 3.2, « Special considerations for Safety Culture Self Assessments » [1, p. 17-18], comprend des renseignements additionnels.

La sûreté et la sécurité constituent des objectifs intégrés pour toutes les installations nucléaires. Bien que les méthodes d'évaluation de la culture de sûreté et de la culture de sécurité soient généralement semblables, une évaluation de la culture de sécurité met davantage l'accent sur l'atténuation des risques (probabilités et conséquences) liés à des actes malveillants délibérés. Par conséquent, le cadre de référence exhaustif de la culture de sûreté (annexe A) présente trois indicateurs propres à la culture de sécurité : le soupçon d'une menace plausible, les mesures de contrôle des employés ainsi que la classification et le contrôle des renseignements de nature délicate. Les évaluations de la culture de sûreté pourraient également permettre d'évaluer la culture de sécurité, mais les titulaires de permis peuvent choisir de réaliser des évaluations indépendantes pour chacune.

3.3 Planification de l'évaluation

La planification de l'évaluation consiste à appliquer la méthode choisie et le cadre d'évaluation connexe, ainsi qu'à déterminer en détail comment les données seront recueillies, analysées, interprétées et communiquées.

La compréhension du fait que la culture de sûreté peut évoluer au fil du temps (Principe 3) aidera l'organisation à maintenir la sûreté et à l'améliorer. On peut utiliser un modèle de maturité pour décrire et interpréter la culture de sûreté de l'organisation, afin qu'il soit possible de surveiller cette culture et de l'améliorer (voir l'annexe B).

Dans la description des buts de l'évaluation de la culture de sûreté, on devrait expliquer comment l'évaluation soutient les objectifs organisationnels. Un aperçu de la façon dont l'évaluation de la culture de sûreté est liée aux programmes et pratiques organisationnels pertinents (par exemple, programmes de mesures correctives et préventives, gestion de la performance humaine, communications) devrait être inclus.

La description de la portée peut comprendre une justification des secteurs organisationnels inclus dans l'évaluation (par exemple, services, fonctions, groupes de travail, entrepreneurs sur place).

S'il ne s'agit pas de la première évaluation de la culture de sûreté du titulaire de permis, la planification peut comprendre l'examen des évaluations antérieures et les plans d'amélioration qui en ont découlé, afin de déterminer quelle a été l'influence des mesures prises sur la culture de sûreté de l'organisation.

Le rapport n^{o} 83 de la Collection Rapports de sûreté de l'AIEA, *Performing Safety Culture Assessments*, sections 4.1-4.3, « Organizational Readiness, Application of Shared Space in Safety Culture Assessments, et Process Flow and Steps » [1, p. 19-26], comprend un aperçu du processus d'évaluation.

Les documents utilisés à la phase de planification peuvent comprendre le contexte organisationnel (taille, risques, complexité du travail), qui a été pris en compte lors de la détermination de l'étendue et de la profondeur de la collecte et de l'analyse des données, de même qu'un aperçu de chaque phase de l'évaluation, incluant les échéanciers connexes.

3.3.1 Sélection de l'équipe d'évaluation

La sélection d'une équipe d'évaluation appropriée est essentielle pour assurer le perfectionnement et l'amélioration continus du processus d'évaluation et des résultats qui en découlent.

On devrait choisir les membres de l'équipe de manière à assurer que l'ensemble des membres possèdent des connaissances et une expertise adéquates sur le plan de la culture de sûreté et de la technologie de l'organisation. Une pratique exemplaire consiste à inclure dans l'équipe des représentants de l'organisation d'un autre titulaire de permis ou de l'industrie. Les évaluateurs qui prennent part à des vérifications effectuées par les pairs ont une connaissance plus approfondie de l'industrie et peuvent aussi avoir un avantage au chapitre des personnes interrogées et de l'interprétation des données de manière plus objective.

Ensemble, les membres de l'équipe devraient posséder des connaissances et de l'expérience dans les domaines suivants :

- les facteurs humains ainsi que les sciences du comportement et les sciences sociales
- les méthodes qualitatives et quantitatives d'évaluation d'une culture
- les évaluations de la culture de sûreté
- les spécialités des divers domaines fonctionnels (par exemple, sécurité, travailleurs syndiqués ou non, le cas échéant, opérations, entretien, personnel des sièges sociaux, cadres)
- les technologies utilisées au sein de l'organisation

L'équipe dans son ensemble peut refléter une représentation équilibrée des éléments susmentionnés, et l'on devrait notamment prendre en compte la composition démographique de l'effectif (âge, sexe, ancienneté).

Le ou les chefs de l'équipe d'évaluation peuvent avoir de l'expérience et de solides connaissances quant à la culture de sûreté, à la surveillance de cette culture, ainsi qu'aux méthodes d'évaluation et d'amélioration. Leurs responsabilités peuvent comprendre les suivantes :

- sélectionner les membres de l'équipe et les former, au besoin
- déterminer les rôles et responsabilités des membres de l'équipe
- planifier et coordonner l'évaluation
- assurer la liaison avec la direction et les leaders au sein de l'organisation (syndicats, travailleurs très expérimentés)
- communiquer avec l'organisation
- s'assurer que l'organisation a l'évaluation à cœur
- superviser le processus d'évaluation
- prendre des mesures pour surveiller le processus d'évaluation et l'améliorer, au besoin
- établir la version préliminaire et définitive des rapports

Durant l'évaluation, le ou les chefs de l'équipe peuvent prendre des décisions sur tous les aspects du plan d'évaluation (par exemple, liens avec la direction et participation de celle-ci, rôles et formation des membres de l'équipe, application efficace d'un cadre de culture de sûreté et d'une méthode, production de rapports sur les résultats, transition vers les mesures de suivi).

Le rapport n^{o} 83 de la Collection Rapports de sûreté de l'AIEA, *Performing Safety Culture Assessments*, section 4.4, « Team Composition and Competencies, et section 4.5, Roles and Responsibilities » [1, p. 27-30], comprend des renseignements additionnels sur la sélection d'une équipe.

Les documents relatifs à la sélection de l'équipe peuvent comprendre la justification des décisions à l'égard des membres.

3.3.2 Stratégie de communication interne

Les titulaires de permis devraient élaborer et mettre en œuvre une stratégie de communication relative à l'évaluation et envisager de mobiliser de façon proactive les travailleurs et les dirigeants tout au long du processus d'évaluation. Dans la mesure du possible, les évaluations de la culture de sûreté peuvent être intégrées aux stratégies générales de communication des titulaires de permis, de manière à assurer la communication des messages en temps opportun et de façon cohérente. Les titulaires de permis peuvent tenir compte du moment et de la fréquence des communications, des moyens de communication potentiels et des façons d'adapter les messages en fonction de publics particuliers.

Les communications avec les parties intéressées internes peuvent se poursuivre tout au long de l'évaluation et des étapes subséquentes de planification et de mise en œuvre des initiatives d'amélioration. La haute direction devrait promouvoir une participation de l'ensemble de l'organisation à tous les aspects de l'évaluation, au moyen de sondages, d'entrevues et d'autres outils d'évaluation.

Dans le cas de la culture de sécurité, le plan de communication doit tenir compte du fait que certains renseignements sont de nature délicate; cependant, dans l'intérêt d'une plus grande sensibilisation, tous les aspects peuvent faire l'objet de communications étendues même si cela nécessite que certains incidents ou leçons tirées soient généralisés.

Une stratégie de communication peut, aux divers stades de l'évaluation et des activités de suivi, comprendre un résumé de la méthode d'évaluation, des conclusions tirées et des plans d'amélioration. Dans la mesure du possible, l'information devrait être communiquée aux parties intéressées internes suivantes :

- les travailleurs
- la direction
- les groupes de l'organisation qui ont des fonctions ou des exigences spéciales (par exemple, sécurité, comités de santé et de sécurité au travail, délégués syndicaux, entrepreneurs)

Les titulaires de permis peuvent s'attendre à recevoir une rétroaction des parties intéressées et encourager une telle rétroaction. Celle-ci peut donner un aperçu de la culture de l'organisation et peut être utilisée pour peaufiner la stratégie de communication.

Le rapport n° 83 de la Collection Rapports de sûreté de l'AIEA, *Performing Safety Culture Assessments*, section 4.3, « Process Flow and Steps », en particulier les résultats d'une évaluation à la section 7.2, « Communicating the Results » [1, p. 19-26, 46-47], comprend des renseignements additionnels sur la communication au fil du processus d'évaluation.

Les documents relatifs à la stratégie de communication peuvent comprendre le plan de communication. Les dossiers relatifs à la stratégie de communication peuvent comprendre les communications elles-mêmes.

3.3.3 Cadre d'évaluation

Selon le Principe 5, les activités d'évaluation et d'amélioration de la culture de sûreté sont éclairées par un cadre défini énonçant des caractéristiques clés connues pour refléter une culture saine. Le cadre de la culture de sûreté constitue le fondement d'un examen systématique de cette culture en fonction d'un ensemble défini de caractéristiques. Il fournit également un vocabulaire commun facilitant les communications et favorise l'élaboration des plans d'amélioration pour donner suite aux perceptions et aux attitudes communes des travailleurs. Plusieurs cadres de culture de sûreté sont actuellement utilisés dans diverses organisations et dans divers contextes où les titulaires de permis exercent leurs activités.

Les titulaires de permis devraient s'assurer que le cadre d'évaluation est fondé sur les cinq caractéristiques de la culture de sûreté (voir l'annexe A du présent document).

3.3.4 Sélection de la méthode d'évaluation

Pour déterminer la méthode d'évaluation, il est possible de prendre en considération plusieurs facteurs, notamment la taille et la complexité de l'organisation, ainsi que les risques et conséquences associés à l'activité autorisée. L'évaluation peut tenir compte des croyances et des attitudes communes en matière de sûreté et de sécurité, à tous les échelons et dans tous les secteurs fonctionnels de l'organisation. Les évaluations de la culture de sûreté peuvent comporter une terminologie particulière ainsi que des outils de collecte de données adaptés en fonction des thèmes choisis et des travailleurs visés.

3.4 Collecte de données

Les principales méthodes d'évaluation de la culture de sûreté constituent des outils bien établis en matière de sciences sociales, soit l'examen des documents, des sondages, des groupes de réflexion, des entrevues et l'observation. L'un des éléments clés de ces activités est la confidentialité des participants, qui est essentielle pour obtenir de ces derniers les renseignements nécessaires aux évaluations de la culture de sûreté; par conséquent, l'équipe d'évaluation devrait prendre certaines mesures de précaution (par exemple, restreindre le nombre de membres de l'équipe ayant accès aux renseignements personnels et aux contributions des participants, dépersonnaliser ces contributions) afin de garantir aux participants que les renseignements fournis demeurent confidentiels.

Des renseignements additionnels sur les méthodes se trouvent dans la section 5 entière « Methods » du rapport n^{o} 83 de la Collection Rapports de sûreté de l'AIEA, *Performing Safety Culture Assessments*. Les cinq méthodes de collecte des données, y compris leurs limites et les risques associés, y sont expliquées [1, p. 30-37].

3.5 Analyse des données

La principale méthode d'analyse des évaluations de la culture de sûreté est l'analyse thématique. Cette méthode ne constitue pas un exercice linéaire visant à recueillir des renseignements afin de monter un dossier, mais plutôt une analyse itérative de sources parallèles d'information en vue d'explorer les influences culturelles. Elle met l'accent sur l'analyse des données recueillies en vue de comprendre la culture, plutôt que de simplement mesurer la conformité au cadre.

Pendant le processus, l'équipe d'évaluation pourrait devoir préciser la portée de l'examen afin de déceler d'éventuelles tendances nécessitant une attention additionnelle ainsi que des activités de collecte et d'analyse de données. Tous les nouveaux thèmes qui ressortent au cours de l'évaluation pourraient faire l'objet d'analyses et de réflexions supplémentaires. L'équipe devrait périodiquement passer en revue les objectifs de l'évaluation (tels que ceux qui sont énumérés à la section 3.1 du présent document) afin d'assurer le respect des critères méthodologiques.

Le rapport n^{o} 83 de la Collection Rapports de sûreté de l'AIEA, *Performing Safety Culture Assessments*, section 6, « Conducting the Analysis » et section 6.1, « Working with Qualitative and Quantitative data » [1, p. 38], comprend des renseignements additionnels sur l'analyse.

Les documents liés à la méthode d'évaluation choisie et aux cadres de culture de sûreté connexe peuvent comprendre un exposé indiquant dans quelle mesure les techniques de collecte et d'analyse des données appliquées sont exhaustives, systématiques et rigoureuses.

3.6 Rapport d'évaluation

Un rapport d'évaluation devrait offrir un aperçu des résultats : un résumé du processus d'analyse, faisant état des thèmes généraux aussi bien que des forces de l'organisation et des améliorations possibles. Les conclusions de l'évaluation peuvent être axées sur un secteur ou un thème précis et elles devraient reposer sur des données relatives à l'ensemble de l'organisation. Une description des données et de l'analyse peut être incluse avec chaque conclusion. Le rapport peut exposer les conclusions de l'équipe d'évaluation, y compris les preuves à l'appui en accord avec le cadre d'évaluation choisi. Toute information que l'équipe pourra fournir sur les causes sous-jacentes des conclusions tirées contribuera à l'élaboration du plan d'amélioration.

Le rapport n° 83 de la Collection Rapports de sûreté de l'AIEA, *Performing Safety Culture Assessments*, section 7.1, « Writing the self-assessment report » [1, p. 45-46], comprend des renseignements additionnels sur la rédaction du rapport final.

Les documents relatifs à la synthèse des constatations peuvent comprendre le résumé, une description du processus d'évaluation ainsi que le rapport d'évaluation final.

3.7 Réponse à l'évaluation et transition vers les mesures de suivi

Les titulaires de permis devraient donner suite aux résultats d'une évaluation en élaborant et en mettant en œuvre un plan d'amélioration. Cela peut comprendre d'analyser des résultats de l'évaluation et d'offrir aux dirigeants de l'organisation des occasions de réfléchir à ces résultats. Le processus visant à transposer en mesures les conclusions et les leçons issues de l'évaluation peut être intégré à des programmes et des processus existants, par exemple : des systèmes de repérage et de résolution de problèmes; des programmes de mesures correctives et préventives; des séances de réflexion approfondie des dirigeants sur la culture de la sûreté; des groupes de surveillance de la culture de sûreté; d'autres processus d'amélioration organisationnelle.

Le plan d'amélioration constitue une feuille de route vers la réalisation de la vision de l'organisation concernant la culture de sûreté souhaitée; des objectifs et des échéances devraient être fixés pour réaliser cette vision. Le titulaire de permis peut préciser ou réitérer cette vision dans les communications subséquentes; les caractéristiques d'une saine culture de sûreté peuvent aider à préciser et à peaufiner cette vision, laquelle peut être comparée à l'état actuel de la culture tel qu'il a été cerné par l'évaluation. Toute lacune renseignera la direction sur les éléments à cibler dans le plan d'amélioration et aidera à déterminer les caractéristiques positives qui devraient être protégées et favorisées.

Les titulaires de permis peuvent classer les améliorations par ordre de priorité d'après les résultats de l'évaluation, en prenant en considération les répercussions possibles sur la sûreté et la sécurité, les tendances dégagées des évaluations antérieures et le contexte de l'organisation et de l'environnement de travail ainsi que la vision de l'organisation à l'égard de la culture de sûreté souhaitée. La façon dont le titulaire de permis choisira les améliorations à apporter à la suite d'une évaluation, et son engagement à l'égard de la mise en œuvre de ces améliorations, devraient correspondre à son système de gestion et mener à des améliorations.

Le rapport n° 83 de la Collection Rapports de sûreté de l'AIEA, *Performing Safety Culture Assessments*, section 7.3, « Transition to Action » [1, p. 47-49], comprend des renseignements additionnels sur l'élaboration de mesures.

Les documents liés au rapport d'évaluation et au plan d'amélioration peuvent comprendre une discussion sur la façon dont les conclusions de l'évaluation sont intégrées aux activités de surveillance de la culture de sûreté ainsi qu'aux processus et aux pratiques de l'organisation en vue d'améliorer la sûreté. Des mesures correctives ou préventives précises peuvent être décrites et accompagnées de résultats attendus et de calendriers de mise en œuvre.

Annexe A : Cadre de référence pour la culture de sûreté

La présente annexe fournit de l'orientation pour tous les titulaires de permis.

La liste qui suit est un cadre de référence pour la démonstration de l'engagement à l'égard de la sûreté. Ce cadre décrit cinq caractéristiques d'une saine culture de sûreté. Des indicateurs observables et mesurables sont présentés pour chacune des cinq caractéristiques. Ils peuvent aider les titulaires de permis à démontrer clairement comment ils favorisent la culture de sûreté dans leur organisation. Le cadre est une adaptation des publications suivantes : GS-G-3.5, *The Management System for Nuclear Installations* [6] et Collection Sécurité nucléaire de l'AIEA n° 7, *Culture de sécurité nucléaire* [11]. Puisque les caractéristiques et les indicateurs d'une saine culture de sûreté sont semblables à ceux d'une saine culture de sécurité, ils sont regroupés ci-dessous. Les indicateurs qui s'appliquent uniquement à la culture de sécurité sont signalés par un astérisque (*).

La sûreté est une valeur clairement reconnue

- Des ressources sont affectées en fonction des besoins pour assurer la sûreté.
- De multiples mécanismes sont utilisés pour communiquer avec clarté la valeur de la sûreté dans l'organisation.
- Des décisions reflétant la valeur et la priorité relative accordées à la sûreté sont prises rapidement.
- L'importance de la sûreté est étayée par écrit et démontrée dans la façon dont fonctionne l'organisation.
- La promotion d'une saine culture de sûreté est prédominante dans tous les aspects du système de gestion.
- Les travailleurs comprennent que la sûreté, la sécurité et la production sont intimement liées.
- Les travailleurs comprennent qu'il existe une menace plausible à la sécurité et reconnaissent que la sécurité nucléaire est importante*.
- Il y a un empressement à remédier aux faiblesses ou aux facteurs de vulnérabilité importants en matière de sécurité et de sûreté.

Les responsabilités relatives à la sûreté sont claires

- Il y a des rôles et des responsabilités clairement définis pour tous les échelons et postes au sein de l'organisation.
- Les travailleurs sont responsables du respect des politiques et des procédures établies.
- Des responsabilités partagées en matière de sûreté sont déléguées à des personnes et à des équipes qui détiennent les pouvoirs nécessaires.
- Il y a un niveau élevé de respect et de compréhension des exigences réglementaires.
- Des renseignements complets et exacts sont fournis à la CCSN et à d'autres parties intéressées, le cas échéant, en temps opportun et de manière transparente.
- Les travailleurs démontrent un engagement à l'égard de la sûreté dans l'ensemble de l'organisation et comprennent comment ils contribuent à l'atteinte des objectifs de sûreté.
- Les travailleurs comprennent la façon dont leur rôle et leurs liens contribuent au maintien de la sécurité et de la sûreté.

Une organisation vouée à l'apprentissage est fondée sur la sûreté

- Les leçons tirées des expériences au sein de l'organisation et ailleurs, notamment en ce qui a trait aux réussites et aux difficultés, servent de fondement à l'amélioration continue.
- Des évaluations de la culture de sûreté, notamment des autoévaluations, sont effectuées en vue d'améliorer le rendement.

- Il existe des processus permettant de déceler et de corriger les problèmes sans tarder et permettant d'élaborer et de mettre en œuvre des mesures correctives et préventives ainsi que d'en mesurer l'efficacité.
- Diverses méthodes de formation sont appliquées afin de maintenir et d'améliorer la compétence professionnelle et technique des membres de l'organisation.
- Des indicateurs de rendement en matière de sûreté sont continuellement élaborés, suivis de près et évalués, et des mesures sont prises pour y donner suite.
- Les travailleurs sont encouragés à exprimer leurs préoccupations ou leurs soupçons, et leur geste est reconnu lorsqu'ils le font; ils ne font pas l'objet de représailles. Ils estiment qu'ils sont entendus lorsqu'ils attirent l'attention sur des problèmes.
- Tous les membres de l'organisation se sentent libres de poser des questions afin de constamment remettre en question la sûreté des activités quotidiennes.
- Il y a un perfectionnement systématique des compétences individuelles.
- La diversité des opinions est respectée dans l'ensemble de l'organisation.
- Les leçons tirées sont communiqués aux partenaires nationaux et étrangers.

La sûreté est intégrée dans toutes les activités de l'organisation

- La documentation et les processus, de la planification jusqu'à la mise en œuvre, en passant par l'examen, sont complets et sont respectés, conformément aux exigences du système de gestion.
- Les mesures de contrôle et de classification sont mises en œuvre pour protéger les renseignements de nature délicate.*
- Les indicateurs de rendement en matière de sûreté font constamment l'objet d'un suivi, d'un examen des tendances et d'une évaluation dans le cadre de la surveillance de la sûreté; les indicateurs de rendement inefficaces sont peaufinés et améliorés de manière à constamment refléter la rigueur de la culture de sûreté du titulaire de permis.
- Les processus de contrôle documentés correspondent aux risques et aux menaces associés au rôle et aux responsabilités propres au poste*.
- Les travailleurs ont les connaissances nécessaires des processus de travail et respectent ces processus.
- Les travailleurs participent aux processus d'évaluation des risques et de prise de décisions.
- Les travailleurs sont habilités à repérer les problèmes liés à des questions de sécurité et de sûreté et à y remédier.
- Les locaux sont bien entretenus, le matériel est en bon état et les conditions de travail sont bonnes.

Un processus de leadership en matière de sûreté existe au sein de l'organisation

- Tous les travailleurs participent à la promotion d'une saine culture de sûreté et ont cette culture à cœur.
- Les dirigeants sont visibles et participent activement aux activités préventives et réactives en matière de sûreté.
- Des processus de gestion du changement existent et sont mis en œuvre pour favoriser des transitions harmonieuses.
- La collaboration, le respect mutuel, les comportements soucieux de la sûreté et le travail d'équipe sont encouragés, soutenus et reconnus.
- L'engagement à l'égard de la sûreté est manifeste à tous les échelons de l'organisation.
- L'influence des leaders informels sur la culture de sûreté est reconnue et mise à contribution en vue de promouvoir l'amélioration continue de la culture de sûreté.
- Il y a des attentes claires et des politiques qui favorisent les communications ouvertes.
- Les dirigeants communiquent des attentes claires quant au rendement dans les domaines qui ont des effets sur la sûreté et la sécurité.

- Les décisions prises témoignent de l'adoption d'une approche proactive à long terme en matière de sûreté.
- Les dirigeants n'abusent pas de leur autorité pour esquiver les mesures de sécurité ou de sûreté.
- Les dirigeants cherchent constamment à améliorer la sécurité et à empêcher que le relâchement de la vigilance ne compromette les objectifs globaux en matière de sécurité et de sûreté.

Annexe B : Modèle de maturité de la culture de sûreté

La présente annexe fournit de l'orientation pour tous les titulaires de permis.
La compréhension de la manière dont la culture de sûreté change avec le temps, de façon positive ou négative, est essentielle à sa promotion. Le modèle de maturité de la culture de sûreté présenté ci-dessous ainsi que les indicateurs connexes énumérés à l'annexe C ont été adaptés des publications suivantes de l'AIEA :

- TECDOC n° 1329 de l'AIEA, *Safety Culture in Nuclear Installations: Guidance for Use in the Enhancement of Safety Culture* [18]
- INSAG-15, *Key Practical Issues in Strengthening Safety Culture* [9]
- Collection Rapports de sûreté n° 11, *Developing Safety Culture in Nuclear Activities – Practical Suggestions to Assist Progress* [10]

Il est à noter que des activités ou comportements précis au sein d'une organisation, d'un groupe ou d'une équipe pourront souvent s'inscrire dans plus d'une étape, selon les indicateurs utilisés. Les organisations, groupes ou équipes peuvent fluctuer entre ces étapes au fil du temps.

Le modèle de maturité de la culture de sûreté en trois étapes présenté ci-dessous peut également être utilisé pour évaluer la maturité de la culture de sécurité, de sorte que cette dernière puisse être surveillée et améliorée.

Étape 1 : Culture régie par les exigences

La sûreté est principalement réactive et elle est régie par des règles formelles et des lignes de conduite prescrites par la direction.

La sûreté est principalement considérée comme étant une question technique et de procédure liée à la protection des travailleurs. Le respect des règles établies et des dispositions réglementaires imposées par des instances externes devient le motif prépondérant de la sûreté dans l'accomplissement des tâches. Les violations des procédures sont principalement considérées comme des problèmes liés à des travailleurs individuels, par opposition à un résultat des processus organisationnels. La plupart des travailleurs croient que la sûreté est principalement une responsabilité de la direction ou d'une autorité désignée, et que les exigences et procédures relatives à la sûreté leur sont généralement imposées par d'autres.

Étape 2 : Culture régie par les objectifs

Un bon rendement en matière de sûreté devient un but organisationnel et est principalement envisagé sous forme d'objectifs de sûreté.

Des processus et procédures sont en place pour l'atteinte des objectifs de sûreté. Ces processus reposent sur des objectifs organisationnels clairs qui décrivent comment des valeurs et des objectifs organisationnels précis sont directement liés à la sûreté. Des initiatives d'amélioration sont administrées et surveillées par des personnes dotées de l'expérience et des qualifications adéquates, alors que les travailleurs ont la possibilité de contribuer à des améliorations du rendement en matière de sûreté. Des cibles relatives à la sûreté font l'objet d'une surveillance aux fins d'efficacité et elles sont renforcées au fil du temps; des objectifs de sûreté sont systématiquement intégrés dans tous les secteurs de l'organisation. Il est établi que le rendement des travailleurs dépend de l'efficacité des systèmes organisationnels.

Étape 3 : Amélioration continue

La sûreté est considérée comme un processus proactif qui s'améliore de façon continue et dont le point de départ est une vision claire commune à tous les travailleurs, de la sûreté et de sa valeur.

Tous les travailleurs, y compris les gestionnaires et les entrepreneurs, participent personnellement et activement à l'amélioration de la sûreté dans l'ensemble de l'organisation. Tous comprennent clairement les exigences liées à la sûreté et la façon dont leurs propres responsabilités contribuent à la réalisation et au maintien d'améliorations apportées à la sûreté dans leurs tâches quotidiennes. Le relâchement de la vigilance à l'égard des risques et des menaces est repéré et éliminé en accordant une attention à la sûreté des processus, et tous les travailleurs adoptent une attitude commune de questionnement.

Annexe C : Modèle de maturité de la culture de sûreté : Indicateurs et comportements précis

La présente annexe fournit des renseignements à l'intention des titulaires de permis d'installations de catégorie II et de substances nucléaires.

Le tableau ci-dessous établit les indicateurs et décrit les comportements précis liés aux trois étapes de maturité de la culture de sûreté d'une organisation. Les sources du présent tableau sont décrites dans le paragraphe d'introduction de l'annexe B.

Indicateur	Étape 1 : Culture régie par les exigences	Étape 2 : Culture régie par les objectifs	Étape 3 : Amélioration continue
Planification	Les problèmes ne sont pas prévus; le titulaire de permis réagit aux problèmes à mesure qu'ils se produisent.	Le titulaire de permis se concentre principalement sur les questions quotidiennes et n'a qu'une préoccupation à long terme limitée pour la création de valeur par l'intermédiaire de la sûreté.	Le titulaire de permis agit stratégiquement en se concentrant sur le long terme, tout en restant conscient du présent. Il cherche à prévoir les problèmes et à en éliminer les causes avant qu'ils n'apparaissent.
Communication et travail d'équipe	Les communications entre les personnes et les services sont médiocres. La collaboration entre les services et les secteurs fonctionnels n'est pas encouragée.	La direction encourage les équipes et les communications interservices et interfonctionnelles. Les membres de la haute direction travaillent en équipe et coordonnent les décisions des services ainsi que les décisions fonctionnelles.	Les travailleurs reconnaissent la nécessité d'une collaboration entre les services et en font la preuve. Ils obtiennent un soutien de la direction, une reconnaissance et les ressources nécessaires pour concrétiser cette collaboration.
Réaction aux erreurs	La plupart des erreurs sont camouflées par des solutions de rechange. Seules les erreurs ayant des conséquences graves sont signalées et le blâme en est rejeté sur les travailleurs, au motif qu'ils ont omis de se conformer aux règles.	L'attitude de la direction face aux erreurs consiste à mettre davantage de contrôles en place, sous forme de procédures et de formation d'appoint; le rejet du blâme sur les travailleurs est moins fréquent.	Presque toutes les erreurs sont envisagées sous l'angle de la variabilité des processus de travail. Il est plus important pour le titulaire de permis de comprendre ce qui s'est passé que de trouver quelqu'un à blâmer; la compréhension acquise est utilisée pour modifier les processus de travail et renforcer les perceptions des travailleurs.
Rôle de la direction	La direction est principalement considérée comme adhérant aux règles, exerçant des pressions sur les travailleurs et escomptant des résultats.	Le rôle de la direction est perçu comme étant l'application de techniques de gestion.	L'encadrement des travailleurs afin d'améliorer le rendement en matière de sûreté fait partie du rôle de la direction. La direction a la responsabilité de modéliser des améliorations continues de la sûreté et doit rendre des comptes à cet égard.

Indicateur	Étape 1 : Culture régie par les exigences	Étape 2 : Culture régie par les objectifs	Étape 3 : Amélioration continue
Apprentissage	Il y a peu d'écoute ou d'apprentissage liés à l'expérience en matière de sûreté au sein de l'organisation ou ailleurs. Une attitude défensive est adoptée face aux critiques constructives.	Le titulaire de permis est relativement ouvert à l'idée d'apprendre d'autres organisations, particulièrement en ce qui a trait aux techniques et aux pratiques exemplaires.	L'apprentissage reçu des autres, au sein de l'organisation et ailleurs, est considéré comme précieux; du temps est libéré et consacré à l'adaptation des connaissances ainsi acquises afin d'améliorer le rendement en matière de sûreté.
Valeur de la sûreté (« équilibre entre la sûreté et la production »)	La sûreté est considérée comme une nuisance imposée. Les objectifs de profit ou de productivité à court terme sont considérés comme primordiaux et ont souvent la priorité sur la sûreté.	On croit que la sûreté entraîne des coûts plus élevés et une réduction de la production.	La sûreté et la production sont considérées comme étant interdépendantes.
Relations avec les intervenants	Les organismes de réglementation, les fournisseurs et les entrepreneurs sont traités avec circonspection ou de façon antagoniste.	La relation du titulaire de permis avec les organismes de réglementation, les fournisseurs et les entrepreneurs est distante plutôt que d'être étroite; une approche circonspecte est adoptée selon laquelle la confiance doit être méritée.	Des relations de collaboration se forment entre le titulaire de permis et les organismes de réglementation, les fournisseurs, les clients et les entrepreneurs.
Valeur de la diversité	Les travailleurs sont considérés comme des « composantes du système » qui sont définis et valorisés uniquement en fonction de ce qu'ils produisent. La diversité est considérée comme une faiblesse.	La diversité est reconnue comme étant importante, mais elle est rarement mise à profit. La diversité est utilisée par intermittence dans les processus décisionnels.	Les travailleurs sont respectés et leur valeur est reconnue pour leur contribution au rendement global et pour leurs connaissances de la sûreté telles qu'elles sont appliquées. La diversité des opinions est recherchée et cautionnée.
Respect des processus	Il n'y a guère ou pas de conscience des processus de travail ou des processus opérationnels. Les attentes ne sont pas consignées par écrit et sont souvent présupposées.	Il y a une conscience croissante des répercussions de l'influence de la culture dans le milieu de travail. On ne comprend pas pourquoi les contrôles supplémentaires ne produisent pas les résultats escomptés au titre du rendement en matière de sûreté. Les attentes sont consignées par écrit et leur respect est escompté.	Les travailleurs croient aux processus opérationnels de l'organisation, les respectent et aident la direction à en assurer la surveillance.

Indicateur	Étape 1 : Culture régie par les exigences	Étape 2 : Culture régie par les objectifs	Étape 3 : Amélioration continue
Gestion des conflits	Les dissidents sont punis pour leurs points de vue. Il y a une relation antagoniste entre la direction et les autres travailleurs.	Les dissidents sont tolérés, mais ne sont pas encouragés. Les conflits sont considérés comme perturbants et sont découragés au nom du travail d'équipe.	Les questions sont encouragées et les points de vue dissidents sont appréciés. Les conflits sont reconnus et sont résolus par la découverte de solutions mutuellement avantageuses. La direction et les travailleurs ont une relation respectueuse et coopérative.
Perception des systèmes	Les travailleurs accomplissent leurs tâches isolément; on entend souvent dire : « Ce n'est pas mon problème ».	Les travailleurs sont conscients des effets sur l'organisation, de leur rôle et des tâches qu'ils accomplissent.	Les travailleurs sont pleinement conscients des objectifs organisationnels généraux et de la façon dont ils contribuent à les atteindre. Les décisions sont prises en tenant compte de l'ensemble du contexte, de leurs répercussions en matière de sûreté sur les processus de travail ou processus opérationnels, de même que sur les services et le rendement global en matière de sûreté.
Gestion du rendement	Les mesures incitatives liées au rendement ne correspondent pas aux objectifs de sûreté et de sécurité. Les travailleurs sont récompensés pour leur obéissance et pour ce qu'ils produisent et livrent, peu importe les conséquences à long terme.	Les mesures incitatives individuelles liées au rendement correspondent à l'atteinte des objectifs de sûreté et de sécurité. Il est important d'atteindre ou de dépasser les objectifs de productivité à court terme; les travailleurs sont récompensés lorsqu'ils dépassent les objectifs, peu importe les résultats ou les conséquences à long terme.	Les mesures incitatives liées au rendement – individuelles et collectives – correspondent à l'atteinte des objectifs de sûreté et de sécurité. Le rendement à court terme est mesuré et analysé de telle sorte que des changements puissent être apportés pour améliorer le rendement à long terme. Le titulaire de permis récompense non seulement ceux qui produisent, mais aussi ceux qui soutiennent les travaux des autres, de même que l'atteinte des objectifs organisationnels, y compris en matière de sûreté. Les travailleurs sont aussi récompensés tant pour l'amélioration des processus que pour les résultats.

Indicateur	Étape 1 : Culture régie par les exigences	Étape 2 : Culture régie par les objectifs	Étape 3 : Amélioration continue
Rétroaction	Une rétroaction est rarement fournie.	Une rétroaction est fournie et une amélioration est escomptée en conséquence, peu importe le contexte.	La rétroaction est courante et il devient habituel de l'utiliser pour apporter des améliorations.
Formation	La formation est perçue comme une obligation imposée et comme une entrave à l'accomplissement du travail.	La formation est perçue comme une nécessité.	La formation est perçue comme un investissement.

Glossaire

Les définitions des termes utilisés dans le présent document figurent dans le REGDOC-3.6, *Glossaire de la CCSN*.

Le REGDOC-3.6 fournit des termes et des définitions utilisés dans la *Loi sur la sûreté et la réglementation nucléaires* (LSRN), ses règlements d'application ainsi que des documents d'application de la réglementation et d'autres publications de la CCSN. Il est fourni à titre de référence et pour information.

culture de sécurité
Caractéristiques d'un environnement de travail, comme les valeurs, les règles et la compréhension commune, qui influent sur les perceptions et les attitudes des employés à l'égard de l'importance que l'organisation accorde à la sécurité.

évaluation de la culture de sûreté
Évaluation périodique de la culture de sûreté qui fait appel à un cadre et à une méthode prédéfinis pour la collecte des données, leur analyse, leur interprétation et leur communication.

organisation axée sur l'apprentissage
Environnement de travail où les gens accroissent constamment leur aptitude à atteindre leurs objectifs, où l'on encourage des manières nouvelles et stimulantes d'interagir et de se comporter en vue de relever les défis organisationnels futurs et où tous ont la possibilité de donner ensemble un sens à leur travail.

travailleur
Personne qui effectue un travail mentionné dans un permis.
Remarque : Cette définition s'applique aux entrepreneurs et aux sous-traitants, ainsi qu'aux travailleurs directement employés par un titulaire de permis.

Références

1. Agence internationale de l'énergie atomique (AIEA), Collection Rapports de sûreté de l'AIEA n° 83, *Performing Safety Culture Self Assessments*, Vienne, 2016.

2. Groupe CSA, N286-F12, *Exigences relatives au système de gestion des installations nucléaires*, Mississauga, 2012.

3. AIEA, Collection Normes de sûreté de l'AIEA n° SF-1, *Principes fondamentaux de sûreté*, Vienne, 2006.

4. AIEA, Collection Normes de sûreté de l'AIEA n° GSR Partie 1, *Cadre gouvernemental législatif et réglementaire de la sûreté*, Vienne, 2010.

5. AIEA, Collection Normes de sûreté de l'AIEA n° GSR Partie 2, *Leadership and Management for Safety*, Vienne, 2016.

6. AIEA, Collection Normes de sûreté de l'AIEA n° GS-G-3.5, *The Management System for Nuclear Installations*, Vienne, 2009.

7. AIEA, Collection Normes de sûreté de l'AIEA n° NS-G-2.4, *L'organisme exploitant des centrales nucléaires*, Vienne, 2001.

8. AIEA, rapport du Groupe consultatif international pour la sûreté nucléaire INSAG-24, *The Interface Between Safety and Security at Nuclear Power Plants*, Vienne, 2010.

9. AIEA, rapport du Groupe consultatif international pour la sûreté nucléaire INSAG-15, *Key Practical Issues in Strengthening Safety Culture*, Vienne, 2002.

10. AIEA, Collection Rapports de sûreté n° 11, *Developing Safety Culture in Nuclear Activities – Practical Suggestions to Assist Progress*, Vienne, 1998.

11. AIEA, AIEA Information Circular 274 Rev. 1 Mod. 1 *Amendment to the Convention on the Physical Protection of Nuclear Material*, Vienne, 2016.

12. AIEA, Collection Sécurité nucléaire de l'AIEA n° 7, *Culture de sécurité nucléaire*, Vienne, 2008.

13. AIEA, AIEA-TECDOC n° 1801, *Management of the Interface between Nuclear Safety and Security for Research Reactors*, Vienne, 2016.

14. AIEA, Collection Sécurité nucléaire de l'AIEA no 20, *Objectif et éléments essentiels du régime de sécurité nucléaire d'un état*, Vienne, 2013.

15. AIEA, Collection Sécurité nucléaire de l'AIEA no 13, *Recommandations de sécurité nucléaire sur la protection physique des matières nucléaires et des installations nucléaires* (INFCIRC/225/Révision 5), Vienne, 2011.

16. AIEA, Collection Sécurité nucléaire de l'AIEA no 14, *Recommandations de sécurité nucléaire relatives aux matières radioactives et aux installations associées*, Vienne, 2011.

17. Nuclear Energy Institute, NEI 09-07, Révision 1, *Fostering a Healthy Nuclear Safety Culture*, Washington, 2014.

18. AIEA, AIEA-TECDOC n° 1329, *Safety Culture in Nuclear Installations : Guidance for Use in the Enhancement of Safety Culture*, Vienne, 2002.

Renseignements complémentaires

1. Commission canadienne de sûreté nucléaire, historique du document de travail DIS-12-07, *Culture de sûreté chez les titulaires de permis nucléaires*, Ottawa, 2013.

2. Agence internationale de l'énergie atomique (AIEA), AIEA-TECDOC n° 1707, *Regulatory Oversight of Safety Culture in Nuclear Installations*, Vienne, 2013.

3. AIEA, Guide technique (ébauche), *Enhancing nuclear security in organisations associated with nuclear and/or radioactive material.*

4. Association mondiale des exploitants de centrales nucléaires, PL 2013-1, *Traits of a Healthy Nuclear Safety Culture*, Londres, 2013.

5. Nuclear Quality Standard Association, NSQ-100 Guidelines: Section B – Safety Culture, 2016.

6. AIEA, Guide technique de la Collection Sécurité nucléaire de l'AIEA n° 28-T, *Self-Assessment of Nuclear Security Culture in Facilities and Activities*, Vienne, 2017.

Séries de documents d'application de la réglementation de la CCSN

Les installations et activités du secteur nucléaire du Canada sont réglementées par la Commission canadienne de sûreté nucléaire (CCSN). En plus de la *Loi sur la sûreté et la réglementation nucléaires* et de ses règlements d'application, il pourrait y avoir des exigences en matière de conformité à d'autres outils de réglementation, comme les documents d'application de la réglementation ou les normes.

Depuis avril 2013, la collection des documents d'application de la réglementation actuels et prévus comporte trois grandes catégories et vingt-cinq séries, selon la structure ci-dessous. Les documents d'application de la réglementation préparés par la CCSN font partie de l'une des séries suivantes :

1.0 Installations et activités réglementées

Séries 1.1 Installations dotées de réacteurs
1.2 Installations de catégorie IB
1.3 Mines et usines de concentration d'uranium
1.4 Installations de catégorie II
1.5 Homologation d'équipement réglementé
1.6 Substances nucléaires et appareils à rayonnement

2.0 Domaines de sûreté et de réglementation

Séries 2.1 Système de gestion
2.2 Gestion de la performance humaine
2.3 Conduite de l'exploitation
2.4 Analyse de la sûreté
2.5 Conception matérielle
2.6 Aptitude fonctionnelle
2.7 Radioprotection
2.8 Santé et sécurité classiques
2.9 Protection de l'environnement
2.10 Gestion des urgences et protection-incendie
2.11 Gestion des déchets
2.12 Sécurité
2.13 Garanties et non-prolifération
2.14 Emballage et transport

3.0 Autres domaines de réglementation

Séries 3.1 Exigences relatives à la production de rapports
3.2 Mobilisation du public et des Autochtones
3.3 Garanties financières
3.4 Délibérations de la Commission
3.5 Processus et pratiques de la CCSN
3.6 Glossaire de termes de la CCSN

Remarque : Les séries de documents d'application de la réglementation pourraient être modifiées périodiquement par la CCSN. Chaque série susmentionnée peut comprendre plusieurs documents d'application de la réglementation. Pour obtenir la plus récente liste de documents d'application de la réglementation, veuillez consulter le site Web de la CCSN.

Consultation Report: REGDOC- 2.1.2, *Safety Culture*

(From the public consultation - September 26, 2016 to January 31, 2017,
the stakeholder workshop - June 26-27, 2017 and
comments received by email - January 9, 2018)

Rapport de consultation : REGDOC-2.1.2, *Culture de sûreté*

(De la période de consultation publique – du 26 septembre 2016 au 31 janvier 2017,
l'atelier avec les parties intéressées – les 26 et 27 juin 2017 et les commentaires reçus
par courriel – le 9 janvier 2018)

Introduction

REGDOC-2.1.2 sets out requirements and guidance for fostering a healthy safety culture. This document is part of the CNSC's Management System series of regulatory documents.

REGDOC-2.1.2 aims to establish a common understanding of what constitutes a healthy safety culture and the importance of fostering safety culture in a licensee's organization.

Introduction

Le document d'application de la réglementation REGDOC-2.1.2 énonce les exigences et l'orientation visant à favoriser une saine culture de sûreté. Ce document fait partie de la série de documents d'application de la réglementation de la CCSN intitulée Système de gestion.

Le document REGDOC-2.1.2 vise à établir une compréhension commune de ce qui constitue une culture de sûreté saine et de l'importance de favoriser une culture de sûreté dans l'organisation d'un titulaire de permis.

Consultation process

CNSC staff are confident that sufficient and meaningful stakeholder consultations have occurred from the time this project began in 2012 to the present draft presented to the Commission for approval.

Below is a chronology of consultation activities which occurred in two phases.

Processus de consultation

Le personnel de la CCSN est d'avis que des consultations suffisantes et significatives avec les parties intéressées ont eu lieu depuis le début de ce projet en 2012 jusqu'à la présentation du présent projet de document à la Commission aux fins d'approbation.

Voici une chronologie des activités de consultation qui se sont déroulées en deux phases.

Phase I: September 2012 to February 2013 – Discussion Paper 12-07

Engagement on the safety culture project began in 2012 with the publication of discussion paper DIS-12-07, *Safety Culture for nuclear licensees*. The CNSC issued this discussion paper for public comment on September 5, 2012 for a 128-day comment period. The discussion paper sought input from

Phase I : Septembre 2012 à février 2013 – Document de travail 12-07

La tenue de séances de mobilisation sur le projet de la culture de sûreté a commencé en 2012 par la publication du document de travail DIS-12-07, *Culture de sûreté chez les titulaires de permis nucléaires*. La CCSN a publié ce document de travail en vue de recueillir les commentaires du public le

stakeholders and the general public. On January 29, 2013 the CNSC posted the comments it received on its website, and issued an invitation to provide feedback for a 14-day period. The CNSC received a total of 17 submissions from stakeholders over the course of both comment periods.

CNSC staff considered all comments received during the public consultation on DIS-12-03 and published a *What We Heard Report*, which provided a summary of the comments. There was general support for the safety culture initiative and some concerns raised with issues such as the application of a graded approach and the need to ensure flexibility for licensees.

The report also indicated that the CNSC was embarking on the development of a safety culture regulatory document to detail requirements and guidance in support of licensees' fostering a healthy safety culture in their respective organisations. The REGDOC promised to clarify the language associated with safety culture and to provide a degree of flexibility, allowing licensees to adapt the guidance to their own needs.

The CNSC also pledged to engage licensees on the topic of safety culture to communicate the proposed graded approach that would be applicable to the different types of licensees.

Feedback received on DIS-12-07 was considered and was used in the creation of the public consultation draft of REGDOC-2.1.2, *Safety Culture*.

5 septembre 2012, pour une période de commentaires de 128 jours. Le document de travail visait à obtenir l'avis des parties intéressées et du grand public. Le 29 janvier 2013, la CCSN a affiché sur son site Web les commentaires reçus et a publié une invitation à présenter de la rétroaction pendant une période de 14 jours. Au total, la CCSN a reçu 17 documents de parties intéressées au cours des deux périodes de commentaires.

Le personnel de la CCSN a examiné tous les commentaires reçus dans le cadre de la consultation publique sur le document de travail DIS-12-07et a publié un *Rapport ce que nous avons entendu*, qui présente un résumé des commentaires. On appuyait de manière générale l'initiative de la culture de sûreté et certaines préoccupations ont été soulevées relativement à des questions telles que l'application d'une approche graduelle et la nécessité d'assurer une souplesse pour les titulaires de permis.

Le rapport indiquait également que la CCSN entamait la rédaction d'un document d'application de la réglementation sur l'établissement d'une culture de sûreté pour expliquer en détail les exigences et l'orientation incitant les titulaires de permis à favoriser une culture de sûreté saine dans leur organisation. Le REGDOC promettait de préciser la terminologie associée à la culture de sûreté et de prévoir une certaine souplesse afin de permettre aux titulaires de permis d'adapter l'orientation en fonction de leurs besoins.

La CCSN s'était également engagée à tenir des discussions avec les titulaires de permis sur le sujet de la culture de sûreté afin de communiquer la méthode graduelle proposée qui s'appliquerait aux différents types de titulaires de permis.

La rétroaction reçue relativement au document de travail DIS-12-07 a été examinée et a servi à la création de la version de consultation

Phase II: September 2016 to June 2017 public consultation on draft REGDOC-2.1.2, *Safety Culture*

Public consultation on REGDOC-2.1.2, *Safety Culture*, was held from September 26, 2016 to January 31, 2017.

During the consultation period, in January 2017, a stakeholder workshop was held to discuss clarification issues in the draft REGDOC. Issues discussed at the workshop were formally submitted as per normal public consultation practice.

During the consultation period the CNSC received 169 comments from 13 respondents: Areva, Bruce Power, Cameco Corporation, Canadian Nuclear Association, Canadian Nuclear Laboratories, Canadian Nuclear Workers' Council, New Brunswick Power, Nordion, Ontario Power Generation, Power Workers' Union, SNC-Lavalin Nuclear Inc., J. Froats (University of Ontario Institute of Technology) and Winnipeg Regional Health Authority.

Following the public consultation period, submissions from respondents were posted on the CNSC's website from March 23 to April 6, 2017 for feedback on the comments received. No additional comments were received.

The CNSC held a workshop with stakeholders who commented on REGDOC-2.1.2 on June 27-28, 2017 to discuss comments received through the public consultation and feedback on comments periods. The workshop provided an opportunity to discuss and clarify comments received, and further improve the clarity of the draft regulatory document. During the workshop, bulleted "What We Heard" slides were developed and agreed upon by participants. Subsequently the individual bullets were entered into the last section of the Public Consultation Comments Table and are

Phase II : Consultation publique de septembre 2016 à juin 2017 sur le projet de REGDOC-2.1.2, *Culture de sûreté*

Des consultations publiques sur le document REGDOC-2.1.2, *Culture de sûreté*, ont eu lieu du 26 septembre 2016 au 31 janvier 2017.

Au cours de la période de consultation, en janvier 2017, un atelier à l'intention des parties intéressées a eu lieu afin de discuter des questions de clarification dans le projet de REGDOC. Les questions abordées dans le cadre de l'atelier ont été soumises officiellement conformément aux pratiques habituelles en matière de consultation publique.

Au cours de la période de consultation, la CCSN a reçu 169 commentaires de 13 répondants : Areva, Bruce Power, Cameco Corporation, l'Association nucléaire canadienne, les Laboratoires Nucléaires Canadiens, le Conseil canadien des travailleurs du nucléaire, Énergie du Nouveau-Brunswick, Nordion, Ontario Power Generation, le Syndicat des Travailleurs et Travailleuses du Secteur Énergétique, SNC-Lavalin Nuclear Inc., J. Froats (Institut universitaire de technologie de l'Ontario) et l'Office régional de la santé de Winnipeg.

Après la période de consultation publique, les commentaires présentés par les parties intéressées ont été affichés sur le site Web de la CCSN du 23 mars au 6 avril 2017 afin de recueillir de la rétroaction sur les commentaires reçus. Aucun autre commentaire n'a été reçu.

La CCSN a tenu un atelier les 27 et 28 juin 2017 avec les parties intéressées qui ont formulé des commentaires sur le document REGDOC-2.1.2 pour discuter des commentaires reçus dans le cadre de la consultation publique, et de la rétroaction sur les commentaires. Cet atelier a permis de

part of the Commission Member Document (CMD) package submitted in support of this REGDOC.

An email containing the revised REGDOC was sent to all who participated in the public consultation process on November 30, 2017. Following the reception of the email, the CANDU Owners Group (COG) and John Froats (University of Ontario Institute of Technology professor and COG safety culture trainer) have sent further comments on January 9, 2018. 26 additional comments were received. Most of those comments were a duplication of what had already been submitted by stakeholders during the public consultation and/or the June 2017 workshop.

clarifier les commentaires reçus et d'en discuter, ainsi que d'améliorer davantage la clarté du projet de document d'application de la réglementation. Lors de l'atelier, des diapositives présentant des listes à puces sur « ce que nous avons entendu » ont été créées et approuvées par les participants. Par la suite, toutes les puces ont été intégrées à la dernière section du tableau de réponse aux commentaires et font partie de la trousse de documents à l'intention des commissaires soumise à l'appui du document REGDOC.

Un courriel contenant le document REGDOC révisé a été envoyé à toutes les personnes qui ont participé au processus de consultation publique le 30 novembre 2017. Après la réception du courriel, le Groupe des propriétaires de CANDU a présenté d'autres commentaires le 9 janvier 2018. Au total, 19 autres commentaires ont été reçus. La plupart de ces commentaires avaient déjà été soumis par les parties intéressées lors de la période consultation publique et/ou de l'atelier tenu en juin 2017.

Key comments

The following summarizes the key comments received during the consultation period and provides the CNSC's responses:

Comment 1:

Class II and nuclear substances licensees stakeholders requested the CNSC add clarity to the scope of the document, in designating which requirements and guidance apply to which licensees.

CNSC staff response:

CNSC staff acknowledged the concerns expressed by licensees regarding the applicability of requirements and guidance to various licensees. In response to comments, the REGDOC was modified to include clear statements in each requirements section about which requirements and guidance applied to

Principaux commentaires

Les principaux commentaires reçus lors de la période de consultation sont résumés ci-après, accompagnés des réponses de la CCSN.

Commentaire 1

Les parties intéressées ont demandé des précisions sur la portée du document, plus particulièrement en ce qui a trait à la mise en œuvre des exigences et de l'orientation pour les différents types de titulaires de permis.

Réponse du personnel de la CCSN

Le personnel de la CCSN a reconnu les préoccupations exprimées par les titulaires de permis quant à l'applicabilité des exigences et de l'orientation aux divers titulaires de permis. En réponse aux commentaires, le REGDOC a été modifié de manière à y inclure des énoncés clairs dans chaque section relative aux

which licensees.

Comment 2:

Stakeholders raised concerns over the existence of multiple "safety culture" definitions and associated frameworks. In addition to the CNSC definition used in the REGDOC, the World Association of Nuclear Operators/Institute of Nuclear Power Operations (WANO/INPO) and the International Atomic Energy Agency (IAEA) have other definitions.

A common definition was viewed as key to ensuring a common understanding of the term and therefore would provide a basis for regulatory clarity.

CNSC staff response:

The REGDOC maintains the CNSC definition. The CNSC's definition was a result of thorough research and discussions on safety culture and has been used since the 1990's (See Appendix B of the CMD, Synopsis from Science and Benchmarking-sections 1.3 and 2) All the safety culture definitions highlight similar elements and have similar goals. Minor variations in the definitions of the WANO/INPO, IAEA and the CNSC, do not affect requirements.

While the REGDOC maintains the CNSC definition, it was made clear to stakeholders that they have the flexibility to use whatever recognized definition suits the organizational needs. See Appendix B of the CMD, Synopsis from Science and Benchmarking-section 1 for more information and benchmarking on the importance of safety culture and section 1.3 for safety culture definitions.

The safety culture reference framework was modified in the REGDOC in response to

exigences au sujet des exigences et de l'orientation qui s'appliquent à chacun des titulaires de permis.

Commentaire 2

Les parties intéressées ont soulevé des préoccupations relativement à l'existence de définitions multiples de la « culture de sûreté » et aux cadres connexes. En plus de la définition de la CCSN utilisée dans le REGDOC, l'Association mondiale des exploitants de centrales nucléaires/Institute of Nuclear Power Operations (WANO/INPO) et l'Agence internationale de l'énergie atomique (AIEA) utilisent d'autres définitions.

Une définition commune était considérée essentielle pour garantir une compréhension commune du terme et par conséquent, constituerait un fondement pour la clarté de la réglementation.

Réponse du personnel de la CCSN

Le document REGDOC conserve la définition de la CCSN, mais le cadre connexe a été modifié en réponse aux commentaires des parties intéressées. De légères variations dans les définitions de la WANO/INPO, de l'AIEA et de la CCSN n'ont aucune incidence sur les exigences. Toutes les définitions de la culture de sûreté soulignent des éléments semblables et ont des objectifs similaires.

Les titulaires de permis sont libres d'utiliser la définition qui convient le mieux à leur organisation et peuvent utiliser d'autres cadres à condition de pouvoir les mettre en correspondance avec le cadre de la CCSN.

stakeholder comments. In addition, licensees can use their own frameworks, the requirement is that they must be mapped to the CNSC safety culture reference framework; this would be a one-time exercise. See Appendix B of the CMD, Synopsis from Science and Benchmarking-section 8 for more information and benchmarking on safety culture frameworks.

Comment 3:

A second key definition issue raised by licensees was the CNSC staff's integration of security culture to safety culture. The concerns with the inclusion of "security culture" were two-fold:

- Security culture and safety culture are separate concepts and what is applicable to one concept is not necessarily applicable to the other. For example, the World Institute for Nuclear Security (WINS) security culture sample survey contains questions that are more fact based whereas safety culture questions tend to be more based on opinions and perceptions.

They find that security culture is not as mature as safety culture, which industry has been developing for decades. Multiple methodologies have been developed for safety culture, but no guidance has been published yet for security culture.

CNSC staff response:

The REGDOC was revised to acknowledge the fact that security culture is less mature than safety culture, but that it serves the same objective as safety culture: to limit the risk resulting from nuclear substances and associated facilities. Considering all aspects together enables a higher assurance that the balance between safety and security will be

Commentaire 3

Une deuxième question clé relative à la définition soulevée par les titulaires de permis était l'inclusion par le personnel de la CCSN de la culture de *sécurité* comme composante de la culture de sûreté. Les préoccupations relatives à l'inclusion de la culture de sécurité concernaient deux questions :

- La culture de sécurité et la culture de sûreté sont des concepts distincts et ce qui s'applique à un concept ne s'applique pas forcément à l'autre. À titre d'exemple, l'enquête par sondage sur la culture de sécurité du World Institute for Nuclear Security comprend des questions qui reposent davantage sur des faits tandis que les questions sur la culture de sûreté ont tendance à reposer davantage sur les opinions et les perceptions.
- La culture de sécurité n'est pas un concept aussi mature dans l'industrie nucléaire, donc il ne serait pas raisonnable d'avoir les mêmes attentes en matière de mise en œuvre de la réglementation que dans le cas de la culture de sûreté.

Réponse du personnel de la CCSN

La culture de sécurité demeure une composante de la culture de sûreté et les préoccupations relatives à la culture de sécurité peuvent être atténuées efficacement au sein du cadre global de la culture de sûreté. Toutefois, le texte du REGDOC a été révisé afin de clarifier la relation et de donner suite aux préoccupations des parties intéressées. Une justification

considered. See Appendix A of the CMD, Inclusion of Security Culture for the rationale for why security culture should be in this REGDOC at this juncture.

Comment 4:

Stakeholders expressed three key concerns regarding periodic safety culture assessments:

- the requirements to conduct safety culture assessments that were "empirical, valid, practical, and functional" was viewed as too prescriptive and as placing too much emphasis on quantitative data
- the requirements to report on assessment outside the organization could cause a 'chilling effect' on employee responses

the requirement to conduct assessments every three years was viewed as too frequent.

CNSC staff response:

- CNSC staff agree that qualitative methods and terminology are important in any

exhaustive pour l'inclusion de la culture de sécurité figure à l'Annexe du tableau de réponse aux commentaires ci-jointe − 1 : Inclusion de la culture de sécurité.

Commentaire 4

Les parties intéressées ont exprimé trois préoccupations principales à l'égard des évaluations périodiques de la culture de sûreté :

- L'exigence relative à la réalisation d'évaluations de la culture de sûreté qui sont « empiriques, valides, pratiques et fonctionnelles » était considérée excessivement empirique tandis que les considérations subjectives font partie intégrante de l'évaluation de la santé de la culture de sûreté d'une organisation.

  Les titulaires de permis craignaient également qu'une approche empirique ne soit utilisée pour comparer les titulaires de permis au fil du temps et entre eux.
- L'exigence relative à la réalisation d'évaluations de la culture de sûreté tous les trois ans était considérée rigide et peu pratique dans le contexte de ce qui est nécessaire pour effectuer une autoévaluation.

La communication des résultats des évaluations de la culture de sûreté à l'externe, y compris avec la CCSN, était considérée problématique. On craignait un « effet paralysant », à savoir que les employés pourraient être réticents à engager des discussions entièrement ouvertes et franches s'ils estimaient que leurs commentaires et opinions pourraient être communiqués plus largement. On a insisté sur le fait que la confidentialité fait partie intégrante de l'évaluation de la culture de sûreté d'une organisation.

Réponse du personnel de la CCSN

- La formulation de l'exigence relative à la réalisation d'évaluations de la culture de

assessment of a healthy safety culture – managers and staff should feel comfortable in articulating their views on their organization's safety culture without feeling constrained by an overly-rigid or technical approach. Furthermore, staff agree that safety culture overall is not something that can or should be quantified in the sense of assigning a numerical value or score. However, it is still important to recognize the need for some degree of empirical methods when gathering and analyzing data in a safety culture assessment. See Appendix B of the CMD, Synopsis from Science and Benchmarking sections 6 and 7 for more information and benchmarking on safety culture assessments.

- In order to better capture this balance between qualitative and quantitative elements, the requirement language in the REGDOC for the conduct of safety culture assessments was revised to reflect terms discussed during the June 2017 stakeholder workshop. The requirement uses less prescriptive terms: "comprehensive, systematic and rigorous.
- The frequency of safety culture assessments has been changed to five years, with guidance that they should be carried out as operational needs dictate, e.g. new ownership, governance, structure, responsibilities or new activities such as refurbishment, decommissioning, etc.

The frequency of performing a safety culture assessment has been changed from three to five years, with guidance that they should be carried out as operational needs dictate, e.g. new ownership, governance, structure, responsibilities or new activities such as refurbishment, decommissioning, etc. The five years frequency allows more flexibility for stakeholders to perform their self-assessment, analyse and document the results and

sûreté a été révisée de manière à tenir compte des termes proposés dans le cadre de l'atelier tenu au mois de juin afin de reconnaître que la culture de sûreté comporte une grande subjectivité.

- La fréquence des évaluations de la culture de sûreté a été modifiée, passant à cinq ans, et une orientation indique qu'elles doivent être réalisées conformément aux besoins opérationnels (p. ex. un nouveau propriétaire, une nouvelle gouvernance, une nouvelle structure, de nouvelles responsabilités ou des activités nouvelles, comme la remise à neuf et le déclassement).

L'exigence relative à la communication des rapports d'évaluation a été supprimée et le plan de communication ne s'applique maintenant qu'aux parties intéressées internes.

implement the improvement plan.

Comment 5:

Stakeholder positions on the inclusion of the Maturity Model as shown in Appendix B of the consultation draft of the REGDOC were divided. Non-Nuclear Power Plants stakeholders found that it was helpful and valuable. Nuclear Power Plants (NPP) licensees found the maturity model to be unclear. They were especially concerned with the inclusion of specific indicators which they understood to have created a second safety culture reference framework. NPP licensees were unsure how the CNSC would expect them to make use of the Maturity Model. They questioned the added value of having the maturity model in the REGDOC and suggested it be removed from the REGDOC. Nuclear power plant licensees requested that the maturity model to be removed from the REGDOC as it implied that there were two safety culture frameworks within the same REGDOC. They further noted that the level of detail included in the table was excessive.

CNSC staff response:

The Maturity Model remains in the REGDOC as it does not contain requirements, and provides useful information to licensees that are less familiar with safety culture. However, the model was modified. The specific indicators that describe behaviours related to the three stages of maturity of an organization's safety culture were separated to become Appendix C. The REGDOC states that the Appendix C indicators are to provide information specifically for Class II and nuclear substances licensees.

The IAEA has been developing guidance on maturity models since the 1990's and industries such as oil and gas, aviation, healthcare, rail and public transportation have used maturity models to develop and evolve

Commentaire 5

Les parties intéressées avaient des opinions divergentes sur l'annexe B : Modèle de maturité de la culture de sûreté dans la version de consultation publique du projet de REGDOC.

- Les titulaires de permis de centrale nucléaire ont demandé que le modèle de maturité soit retiré du REGDOC, car celui-ci donnait à penser qu'il y avait deux cadres de culture de sûreté dans le même document. Ils ont également indiqué que le tableau était trop détaillé.
- En général, les parties intéressées ne provenant pas du milieu des centrales nucléaires soutenaient que l'annexe était utile, surtout pour les organisations qui commencent à se familiariser avec le concept de la culture de sûreté.

Réponse du personnel de la CCSN

- Selon les observations reçues, le modèle de maturité est maintenant divisé en deux sections. La première section fournit des renseignements généraux à l'intention de tous les titulaires de permis. La section contenant des indicateurs particuliers a été conservée et un texte explicatif précise que les indicateurs du modèle de maturité pourraient servir de cadre aux titulaires de permis qui ne connaissent pas les évaluations de la culture de sûreté.

their safety cultures. See Appendix B of the CMD, Synopsis from Science and Benchmarking-section 9 for more information and benchmarking on maturity models.

Concluding remarks

This project has undergone extensive stakeholder consultations over the previous six years. CNSC staff have listened to concerns and the document has been modified, as appropriate.

- The full responses to stakeholder feedback on draft REGDOC-2.1.2, Safety Culture can be found in the comment disposition table included as part of the Commission Member Document package.

Mot de la fin

Ce projet a fait l'objet de vastes consultations avec les parties intéressées au cours des six dernières années. Le personnel de la CCSN a écouté les préoccupations et le document a été modifié, au besoin.

- Les réponses complètes aux observations des parties intéressées relatives au projet de REGDOC-2.1.2, *Culture de sûreté*, figurent dans le tableau de réponse aux commentaires faisant partie de la trousse de documents à l'intention des commissaires.

Public Consultation Comments Table
Draft REGDOC-2.1.2, *Safety Culture*
September 26 – November 28, 2016

Date revised: January 18, 2018

Table A: Comments received on the "Request for Information" that was included for comment with the draft document (Purple banner)
Table B: Comments received during public consultation period September 26-November 28, 2016 - Comments 1-176 (Blue banner)
Table C: Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017 – Comments 177-253(Green banner)

Table A: Comments received during public consultation period September 26- November 28, 2016 [January 31, 2017] (Purple Banner)

Comments received on the "Request for Information" that was included for comment with the draft document			
	Reviewer	**Reviewer's Comment**	**Response**
1	Bruce Power, NB Power, Ontario Power Generation (OPG)	Neither this document nor the draft REGDOC itself are clear on how they will apply to non-NPPs. Section 3 of the Request for Information, under Objectives, says this draft REGDOC "applies to all licensees: it sets requirements and guidance for licensees of Class I nuclear facilities and uranium mines and mills, and provides guidance to all other licensees. The following three requirements support this objective: licensees shall document their commitment to fostering safety culture in their governing documentation licensees shall conduct comprehensive safety culture assessments that are empirical, valid, practical and functional upon completion of a safety culture assessment, the licensees shall prepare a summary report for submission to the CNSC This is written as if all sections are required for all licensees, though points 2 and point 3 are requirements for NPP's and guidance provided for all other facilities. Modify to clearly delineate requirements for different facility types. The CNSC should have a very clear graded approach to implementation of this REGDOC for different types of licensees.	The REGDOC was modified as result of comments. For the sections of the document containing requirements, text was included to clearly state to whom the requirements apply and for whom it is information. For example: 2. Fostering Safety Culture This section contains requirements and guidance applicable to all Class 1 facilities, and Uranium Mines and Mills. This section provides information for all other licensees.

Comments received on the "Request for Information" that was included for comment with the draft document			
	Reviewer	**Reviewer's Comment**	**Response**
		Major Undue burden on facilities to try and understand the intent of regulator or to justify a partial implementation of processes to meet this regulatory document. See comment below.	
2	Bruce Power, NB Power, Ontario Power Generation (OPG)	Under Section 4, Regulatory Approach, this draft says, "The requirements and guidance for safety culture assessments are intended for nuclear power plants" which is an unclear explanation of which requirements and guidance apply to different facilities. In other parts of this Request for Information and the draft REGDOC itself, the wording suggests all facilities should develop processes to the same degree as the NPPs. The CNSC should develop a crystal clear, graded approach to how this, and all other REGDOCS, are implemented and regulated for different types of facilities so all licensees can fully understand their requirements. **Major** As currently written, these documents could result in major, undue harm to smaller facilities (non-NPPs) where requirements are unclear. Many thousands/millions of dollars could be spent trying to rationalize processes as acceptable or to address action notices where facilities did not understand the requirements (or a CNSC inspector incorrectly determined noncompliance with the requirements).	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements.
3	Bruce Power, NB Power, OPG	In Section 5, Potential Impacts, CNSC staff erroneously note, "The requirement to provide a summary report of safety culture assessments may result in a modest administrative burden on nuclear power licensees." This is contrary to the Cabinet directive on Regulatory Management and the Red Tape Reduction Act and the One-for-One rule, since there does not appear to be any administrative burden being removed from licensees. Licensees strongly urge the CNSC to follow the Cabinet directive and the intent of the One-for-One rule. **Major**	The REGDOC was modified as result of comments. The requirement to provide a summary report of safety culture assessments has been removed.

Comments received on the "Request for Information" that was included for comment with the draft document			
	Reviewer	**Reviewer's Comment**	**Response**
		There continue to be an increasing number of administrative burdens placed on licensees through REGDOCs without any relief via the Red Tape Reduction Act and the One-for-One rule. These administrative burdens generally have no nuclear safety benefit, but increase costs to licensees which are passed on to ratepayers. From the Government of Canada website (http://www.tbs-sct.gc.ca/hgw-cgf/priorities-priorites/rtrap-parfa/ofo-upu-eng.asp): "When a new or amended regulation increases the administrative burden on business, regulators are required to offset – from their existing regulations – an equal amount of administrative burden cost on business." Since the CNSC is using REGDOCs instead of regulations to implement new Regulatory Requirements, they are not following the one-for-one rule, which is inappropriate. This is resulting in hundreds of thousands of dollars of administrative burden being added to the licensees each year for this and other REGDOCs.	

Table B: Comments received during public consultation period September 26-November 28, 2016 - Comments 1-176 (Blue banner)

Comments received during public consultation period September 26-November 28, 2016				
	Section	**Reviewer**	**Reviewer's Comment**	**Response**

Comments received during public consultation period September 26-November 28, 2016				
	Section	**Reviewer**	**Reviewer's Comment**	**Response**
4	General –	CNL	CNL agrees that the licensees need to develop and maintain a Nuclear Safety Policy that entails the overriding priority for a strong Nuclear Safety Culture within their organizations and supports the need to conduct self-assessments in order to evaluate the organizational behaviours related to the safety culture and to identify opportunities for improvement.	While comments are acknowledged, no changes to the REGDOC were suggested. CNSC staff acknowledges the recognition of the importance of safety culture to organizations.
5	General - Agreement	SNC- Lavalin	We agree with the CNSC position that a healthy safety culture is a key factor in reducing the likelihood of events and that creating and maintaining an environment conducive to a healthy safety culture is an ongoing process. SNC-Lavalin Nuclear is actively engaged in fostering a healthy safety culture throughout the Company in its roles as: ☐ A licensee (with a Waste Nuclear Substance Licence), ☐ Provider of products and services to the nuclear industry, and ☐ Designer of nuclear power plants.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.
6	General – Agreement	CNA	Our members agree with the CNSC's position that a healthy safety culture is a key factor in the continued safe operation of our facilities. Our members are committed to continuing to engage in activities that foster a healthy safety culture…. I would like to emphasize that the CNA and its members, agree with the CNSC that a strong nuclear safety culture is a vital part of the safe operations of our facilities and we remain committed to working with the CNSC to develop mutually agreed approaches to ensure that continued safety.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.
7	General - Agreement	OPG	In conclusion, OPG reaffirms its commitment to fostering a healthy safety culture, including undertaking assessment activities to understand changes to culture over time and to guide efforts at influencing culture in a way which ensures nuclear safety is always given the priority it deserves.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.
8	General - Agreement	Bruce	This is an area of great interest and activity at Bruce Power, where efforts to nurture a healthy nuclear safety culture touch all corners of our organization. We share the CNCS's conviction that a company's communal beliefs and values are powerful influences on employee attitudes and behaviours and that culture is vital to the enduring success of a multi-pronged safety program	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.

Comments received during public consultation period September 26-November 28, 2016				
	Section	**Reviewer**	**Reviewer's Comment**	**Response**
9	General - Agreement	NB Power	NB Power appreciates the opportunity to provide comments to the CNSC on the draft of Regulatory Document 2.1.2, Safety Culture (Reference 1) because we understand the importance of fostering a positive Nuclear Safety Culture within NB Power.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.
10	General - Agreement	NB Power	In conclusion, NB Power completed a Nuclear Safety Culture assessment in 2016 and remains committed to continually improving and fostering a positive Nuclear Safety Culture.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.
11	General - Agreement	Areva	AREVA is committed to fostering a healthy safety culture and has integrated our commitment into the organization's governing documentation. We periodically conduct assessments to better understand our safety culture and to drive continual improvement.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.
12	General - Agreement	OPG	OPG agrees that licensees need to foster a healthy safety culture within their organizations, including developing a Nuclear Safety Policy that sets the overriding priority for a strong Nuclear Safety Culture. In addition, OPG supports the need to conduct self assessments, scaled to the size of the organization and nature of the industry, in order to assess the organizational behaviors linked to a healthy safety culture. OPG also remains open to have the CNSC review the high level summary report and action plans resulting from these assessments	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.
13	General - Agreement	J Froats	It is my view that we have enjoyed an excellent overall Safety Culture in the Nuclear Power Plants (NPPs) in Canada historically. Never perfect, and always in need of constant nurturing and re-enforcement but overall a strength. This has been achieved through combination of several factors including a robust plant design that reflects safety cultural elements in the design phase, a high commitment to training and education resulting in highly competent and committed licensees and an excellent Regulatory Body in Canada. The focus on Nuclear Safety as an over-riding priority has been a fundamental premise in the Canadian Industry right from the very beginning. There is a routine use of external review in both the Licensees and the Canadian Nuclear Safety Commission and a high level	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.

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			of commitment in Canada to transparency with the public - some of which is on a voluntary or negotiated basis.	
14	General - Agreement	Cameco	Cameco is the licensee for a number of nuclear facilities in Canada, including uranium mines in Saskatchewan and uranium processing facilities in Ontario. Cameco strives to be a leading performer in the areas of safety culture, environmental leadership and operational excellence. Safety is of the utmost importance to our organization and we are committed to promoting a strong safety culture. At the outset, we wanted to emphasize that we were encouraged to see that many of Cameco' s comments submitted on CNSC Discussion Paper DIS-12-07, Safety Culture for Nuclear Licensees (Mooney to Dallaire, January 10, 2013) have been incorporated into the REGDOC…. In closing, Cameco considers safety culture an essential part of our management system and we are committed to ensuring continued safety at all our facilities.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.
15	General - Agreement	Power Workers Union	The PWU previously submitted comments on Discussion Paper DIS-12-07 Safety Culture for Nuclear Licensees. In that submission, as well as many other submissions to the CNSC, we stressed our full support for any initiatives that help promote a healthy safety culture. The PWU is fully engaged to this end with employers at the NPPs in Ontario. The PWU is supportive of the Draft Regulatory Document…	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.
16	General – Agreement	Nordion	Nordion believes that safety culture is extremely important… however as presented in REGDOC-2.1.2, "Safety Culture" it is required to be a standalone program. Currently Nordion addresses many of these requirements as part of our existing radiation safety and conventional health and safety programs. It is Nordion's position that the formal implementation of a safety culture program would be an unnecessary administrative burden requiring considerable cost and effort, with little or no additional safety benefits.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.
17	General	CNL / NB Power	What activities will the CNSC conduct to ensure compliance with the REGDOC? What additional activities will licensees need to perform to meet the requirements in this draft beyond those the CNSC has already observed from existing assessments?	While comments are acknowledged, no changes to the REGDOC were suggested. For each licensee, the implementation plan and timeline for this regulatory document will be established through discussions and consultations between CNSC staff and the licensee.

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				It is the licensees' responsibility to determine how they will meet the requirements contained in this REGDOC.
18	General	SNC- Lavalin	For non-power reactor licensees, what activities will the CNSC conduct to ensure compliance with the REGDOC?	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 17 on compliance.
19	General	SNC- Lavalin	Since NPP licensees already have detailed practices and procedures for Nuclear Safety Culture, the level of detail in the guidance appears to be unnecessary.	The REGDOC was modified as a result of comments provided. A primary function of this document is to provide information for all existing and potential licensees. Revisions were made to the document to clearly identify which parts are meant as information. See comment 1 on applicability of requirements. The CNSC will be providing further clarity concerning guidance through REGDOC 3.5.3, *Regulatory Fundamentals* which will be made available at a later date.
20	General	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Why does the CNSC believe it necessary to include such level of detail in the guidance when it appears the requirements largely apply only to the NPPs, which already have detailed practices and processes?	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 19 on the balance of information and requirements.
21	General -	CANADIAN NUCLEAR WORKERS	As a labour organization the CNWC supports a strong safety culture. Overall we believe that there is a good safety culture across the nuclear industry.	While comments are acknowledged, no changes to the REGDOC were suggested.

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		COUNCIL (CNWC)		See comment 4 on the importance of safety culture.
22	General	Power Workers' Union	Additional information Attached [see below] is a document which describes the PWU interactions in regards to Workplace Health & Safety with OPG & Bruce Power Inc. In conclusion, the PWU is supportive of the CNSC Draft Safety Culture Regulation REGDOC-2.1 .2. Local Joint Health & Safety Committee (JHSC) The JHSC is the centerpiece of the health and safety infrastructure. It is a committee mandated by law on which the PWU appoints half of the members. The PWU representatives are assisted by the local PWU leadership as well as PWU Staff. The PWU has negotiated agreements with our employers to provide Certification training to all JHSC Members. In addition the PWU provides H&S Accreditation training to all JHSC Members and Chief Stewards The following additional health and safety committees have been agreed to with OPS & Bruce Power, through collective bargaining: Joint Policy Committee on Health and Safety Members on these committees consist of the leadership from the Unions, OPG & Bruce Power. The committee's roles include: • developing joint policies and agreements on health and safety issues; • establishing working committees and task groups to address priority issues; and • Identifying, evaluating and making recommendations on key health and safety problems/issues, both existing and emerging. Joint Health and Safety Working Committee These committees consist of representatives from the Company's Corporate Safety Department, PWU Representatives and representatives from the Society of Energy Professionals. The roles of these committees are to: • carry out the work programs as per the Joint Policy Committee; and	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 4 on the importance of safety culture.

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			• Function as a resource for the local JHSC. Joint Committee on Radiation Protection These Committees are enshrined in the PWU Collective Agreements with DPG & Bruce Power. Their purpose is to review radiation protection performance and to provide recommendations to the station general manager with respect to employee and public safety in relation to the radiation safety program. Agreements on Incident Investigations and the Establishment of an Investigator Pool The PWU has negotiated agreements with OPG on incident investigations including the use of trained investigators from our pool for the investigation of incidents that had a high reasonable potential for harm.	
23	General	Power Workers Union	The PWU sees a healthy Safety Culture as a workplace which is a safe place to work; where the health & safety of workers, the public, and the environment is an uncompromised priority; where safety and production are mutually dependent; and where all of the workplace parties collaborate and are fully engaged in fostering a healthy safety culture. All Workers need to be properly trained and feel comfortable asking questions, raising concerns and reporting events or errors including potential incidents. When errors do occur they need to be investigated as an opportunity to learn and improve without the need to assign blame. Investigations need to have the full participation of Workers or Worker Representatives. Performance management and performance incentives should not be structured in a manner that may create an incentive to not report incidents/events	The REGDOC was modified as a result of comments provided. Appendix A , Safety Culture Reference Framework, Characteristic "A Learning Organization is built around safety" bullet now reads: "Workers are encouraged and recognized for reporting concerns or suspicions, are free from reprisal, and feel that they have been heard when they voice issues."
24	General	J Froats	A strong, clear Regulatory Framework is also a key influence on Safety Culture. Since the Discussion Paper was published:	CNSC staff acknowledge that there are many initiatives that have taken place, both in the CNSC's regulatory framework

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			• A significant number of key changes have taken place in the Regulatory Framework including: o Periodic Safety Review o Requirements for Aging Management and Life Extension o Design of New Plants o Focus on Beyond Design Basis Requirements o The Administrative Monetary Penalty Structure (the application of which can influence licensee tolerance for deviation from requirements) It seems to me as well, that we do several things today that have resulted in the strong safety culture we have enjoyed historically - so many elements are already in place - if it is the intent to 'codify' or collect elements into one place perhaps some of what is currently working well should be included: All Canadian NPP's are committed to a cycle of structured external reviews that look at elements of programming including those things that affect safety Culture o · WANO Reviews and or OSART reviews are completed at a relatively high frequency o , Targeted external assessments are utilized -- particularly for major events o Periodic review of causal factors that are contributing to lower level events Resident CNSC inspectors conduct inspections and assessments in a mix of announced and unannounced means There is a strong commitment to an extensive licencing program for control room staff which includes elements of safety cultural education Leadership development initiatives include education on safety culture and its importance Corporate policy documents clearly state that nuclear safety will be an overriding priority There are a great many performance indicators some of which can provide insights to organizational weaknesses so they can be identified and corrected by the required Corrective Action programming Historical clarity arid strength around the role of the Design Authority and the 'internal technical conscience' embodied in the Chief Nuclear Engineer role has contributed. We typically use Safety Culture Surveys, as an input to consider - but not in isolation – as	and in the nuclear power industry, that broadly influence safety culture. The REGDOC topics listed in the response present a partial list of safety culture issues addressed through broader elements of the CNSC's regulatory framework As a part of fostering safety culture, CNSC staff considered that WANO, OSART and other reviews could be used to monitor safety culture more frequently than dedicated assessments. The REGDOC was modified as a result of comments provided. The document has been modified to: a)De-couple continual monitoring from a safety culture self-assessment, and to b)Promote continual monitoring as a fostering safety culture activity.

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			one of many sources to help managers and executives identify areas that need attention. IRRS Missions are held regularly with results made public and are used to strengthen Regulatory oversight which is also a key influence on culture Some National Reports submitted for the conduct of the 7th Convention on Nuclear Safety highlight the use of existing indicators as part of safety culture assessment. Some regulatory bodies around the world have expressed opinion that regulatory assessment via inspection program observation is an important element. It is apparent that there are some good ideas available internationally on utilization of some of the performance indicators available as a part of assessing safety culture.	
25	General	J Froats	The nuclear sector has a strong focus on learning from experience. I think it is worth considering some world experience that might be relevant to our thinking with respect to establishing requirements in the area of safety culture: 1. The Fukushima Daiichi event seemed to have elements of overconfidence in design, overreliance of mathematical risk tools and Executive influence as contributing cultural factors in the event. Also the fact that the plant only had a few years left to run, no doubt had some influence on the perspective of what kind of risk mitigation investment, was thought to be necessary for the remaining life of the Facility. 2. The Chernobyl Event in the Ukraine, had elements of government and Company Executive influence that convinced staff to take the plant outside its safe operating envelope (weaknesses in knowledge (particularly of the design basis and safe operating environment) in the operating staff has also been pointed to in some accounts of the event). Weakness in procedure adherence culture was yet another contributor. 3. Although a Hollywood dramatization, the current film "Deepwater Horizon" vividly depicts another industrial accident that had at its roots a number of Cultural contributors including; a. Acceptance of low standards b. Acceptance of weaknesses in equipment maintenance c. Heavily incented production goals d. Encouragement/ pressure from management and Executives to meet business production 'imperatives'.	While comments are acknowledged, no changes to the REGDOC were suggested. There are several national and international initiatives underway which are addressing the raised comments. As an example, the IAEA has revised GS-R-3 and now GSR Part 2 addresses more explicitly some of the lessons learned related to the systemic issues identified in Fukushima. At this time, the proposed REGDOC is addressing a more focused area of safety culture, namely fostering (policy on safety culture and ongoing monitoring) and how to assess safety culture. Section 2.2 discusses the use of performance indicators. Licensees can include performance indicators to monitor their Safety Culture. See Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2 Safety Culture

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			Note that the earlier Hollywood dramatization of the Titanic accident had several similar contributors. 4. The Lac Megantic event had cultural contributors that were similar. In his book, "The Industrial Operators Handbook", Mr. H. Howlett outlines a couple of the above events as well as many others and provides some additional insights on how these large events develop. So, from historical events, some 'risk elevators' it seems we should be we should be alert to, to preclude major events might include: • Any decline in the understanding of the design basis and safe operating envelope. • Government pressure influence • Weaknesses in understanding of the special .nature of nuclear power in entities like support organizations, Boards, and stakeholders external to the licensees who have influence on the risk tolerance of the organization • Reduction in standards of maintenance and testing • Un-balance in safety as an over-riding priority when challenged by production goals • Management and Executive influence (either systemic in things such as compensation incentives or on individual behavioural bases). • Weaknesses in procedural adherence • Over-reliance and confidence in risk evaluation methods (One.lesson from the Fukushima event that was important was that both consequences and probability of an outcome need to be factored into risk decisions.). Internationally, some other Countries have decided to focus their Regulatory oversight on some leading indicators that they believe to be effective in the detection of erosion in licensee performance of which safety cultural weaknesses may be a contributor. The CNSC also monitors key performance indicators - an aspect that is probably worth including in this REG DOC.	
26	General	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Intent: Could the CNSC please clarify the driver or purpose of the regulation for Class I Nuclear Facilities, which the CNSC acknowledges already do what is expected with regard to safety culture assessments? Is the intent of this REGDOC to be a method of measurement of safety culture or a method of improvement?	The REGDOC was modified as a result of comments provided. The REGDOC describes an acceptable framework for Class I licensees to pursue in order to improve their safety culture. In

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				addition, for Class IA licensees, this regulatory document will describe the expected and suggested criteria for licensees to perform self-assessments. The REGDOC starts with general safety culture information applicable to all licensees and with specific requirements for clearly identified licensees.
27	General	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Could you please clarify what "should" means throughout the draft regulatory document, specifically under the guidance sections?	The REGDOC was modified as a result of comments provided. Guidance language was clarified throughout the document.
28	General	J Froats	And, Regulatory observation of key decision making and risk management against some well-defined criteria, by competent observers has to be an ingredient of evaluation.	While comments are acknowledged, no changes to the REGDOC were suggested. The proposed REGDOC is only part of what the CNSC will do in oversight activities. The CNSC integrates several safety culture aspects into its oversight activities, including the day to day work of site office inspectors.
29	General	J Froats	So, it seems to me, the current draft if intended to give an overview of elements of safety culture programming misses some key elements. Alternatively, If it was intended to be a guide to conduct of safety culture assessment then the title and focus needs to be adjusted accordingly	The REGDOC was modified as a result of comments provided. The REGDOC adopts a pragmatic approach that emphasises engaging licensees to foster/monitor the safety culture in their organisation. Our regulatory framework dictates how titles of REGDOCs are chosen. See comment 24 on continual monitoring.
30	Preface	Areva	Preface – The statement "Licensees are expected to review and consider guidance; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements" places a burdensome obligation on licensees and in so doing, makes the guidance a de facto requirement. The statement should be removed from the	The REGDOC was modified as a result of comments provided. See comment 1 on applicability of requirements.

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			document.	See comment 19 on the balance of information and requirements. This text is standard in all regulatory document prefaces. It serves to remind readers that the guidance provided in regulatory documents should be considered when the applicant or licensee is deciding how to demonstrate that they meet the requirements.
31	Preface	SNC-Lavalin	SNC-Lavalin Nuclear is concerned that the guidance could be interpreted in a prescriptive manner, and that guidance should be clearly stated as guidance, rather than being interpreted as having the effect of regulation. The guidance should be read by everyone to mean that this is a means for satisfying a requirement, but not the only means. SNC-Lavalin Nuclear also recommends that clear distinctions be made in the document to differentiate requirements from guidance.	The REGDOC was modified as a result of comments provided. See comment 19 on the balance of information and requirements. See comment 27 on the guidance language.
32	Preface	CNL	It is unclear to CNL how requirements and guidance will be applied to non-nuclear power plants. This document states: "The requirements and guidance for safety culture assessments are intended for nuclear power plants" and is unclear on which requirements and guidance apply to different facilities. In other parts of the draft REGDOC, the wording suggests all facilities should develop processes to the same degree as the nuclear power plants. Some licensee types have no requirements for this document, only guidance. However, the preface suggests all licensees must follow guidance or justify why they do not. Section 1.2 then discusses how Sections 3 and 4 are intended only for nuclear power plants, yet all licensees must consider how they will address, use a graded approach, or justify a different approach for the guidance in these sections. CNL suggests that the CNSC develop a crystal clear, graded approach to how this REGDOC is implemented and regulated for different types of facilities so all licensees can fully understand their requirements.	The REGDOC was modified as a result of comments provided. See comment 1 on applicability of requirements. See comment 19 on the balance of information and requirements. See comment 27 on the guidance language.

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33	Preface	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	The statement, "Licensees are expected to review and consider guidance; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements" is not reasonable. Guidance is meant to be guidance, if the licensee is required to meet guidance criteria, then it is a requirement, not guidance. Revise wording to: "Licensees are expected to review and consider guidance~~; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements~~." **Major** Licensees note that a similar statement appears in all REGDOCs, which puts an unreasonable onus on licensees to demonstrate not only how requirements are met, but also how guidance is met. Guidance is meant to be guidance. If a licensee is required to meet guidance criteria (even by other means), then it is a requirement, not guidance.	The REGDOC was modified as a result of comments provided. See comment 19 on the balance of information and requirements. See comment 27 on the guidance language.
34	Preface	AREVA	The statement "Licensees are expected to review and consider guidance; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements" places a burdensome obligation on licensees and in so doing, makes the guidance a de facto requirement. The statement should be removed from the document.	While comments are acknowledged, no changes were made to the text of the document. See comment 30 on preface language.
35	Preface	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Some licensee types have no requirements for this document, only guidance. However, the preface suggests all licensees must follow guidance or justify why they do not. Section 1.2 then discusses how Section 3 and 4 are intended only for nuclear power plants, yet all licensees must consider how they will address, use a graded approach, or justify a different approach for the guidance in these sections. This draft should be revised to clearly lay out requirements for all facilities, including what the requirements are for a given section in Table A1 on Page 13 when it lists a facility type as 'G'. In future drafts, licensees urge the CNCS to clearly describe its expectations for how "prudent management practices" should be addressed. Potentially significant financial and administrative burdens could be placed on smaller facilities to interpret expectations, create arguments for a graded approach and justify the processes that are used or implemented as a result of this document. Undue hardship could result from failure to understand requirements. Disagreements	The REGDOC was modified as a result of comments provided. See comment 19 on the balance of information and requirements. See comment 27 on the guidance language. See comment 30 on preface language.

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			between licensees and the regulator regarding interpretations could lead to regulatory actions taken against the licensee, which would negatively affect the perception of their businesses with the regulator and the public in terms of perceived safety performance.	
36	Preface	OPG	OPG believes the Guidance has a degree of detail and prescription that will require significant clarification and is unnecessary given the maturity of the current assessment process used at OPG. A review of the impact of the guidance on OPG is summarized below, however OPG will need clarification on what "should" means throughout this draft regulatory document.	The REGDOC was modified as a result of comments provided. See comment 19 on the balance of information and requirements. See comment 27 on the guidance language.
37	Preface	Cameco	The preface of the REGDOC, like many other REGDOCs, includes the statement, "Licensees are expected to review and consider guidance; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements". As we have commented in past submissions, this undermines the principle of guidance by equating it with regulatory requirements. If the licensee is required to meet guidance criteria, then it is a requirement. This is particularly important in the context of this document where the Scope section states that sections 3 and 4 of the REGDOC are intended for nuclear power plants and that the requirements and guidance in the document "may be used by other licensees…" and Table A1 designates sections 3 and 4 as guidance for some facilities and requirements for other facilities. If the intention is to require Cameco to meet guidance criteria (even by other means), then these requirements would significantly increase the impact of this REGDOC on Cameco. If the intent is to differentiate substantively between requirements and guidance by licence and activity type, then it would provide clarity to both CNSC project officers and licensees during practical implementation of the REGDOC if the above quoted statement is revised to read as follows: "Licensees are expected to review and consider guidance."	The REGDOC was modified as a result of comments provided. See comment 1 on applicability of requirements. See comment 19 on the balance of information and requirements. See comment 27 on the guidance language. See comment 30 on preface language. Table A1 has been removed from the document.
38	Preface	CNA	Before getting into specific comments, I would like to again express the reoccurring concern our members have with the overly rigid and prescriptive nature of "guidance" that consistently reoccurs throughout the revised REGDOCs. Guidance should be guidance; it should not have the effect of regulation. If a licensee is required to meet guidance criteria, it	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 30 on preface language.

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			is a requirement not guidance. As stated above, this is a reoccurring theme in REGDOCs, and one that industry has and will continue to express strong concern with.	
39	Preface	Bruce	But first, let me register my disappointment at the overly rig id and prescriptive guidance throughout this document. Once again, we find a REGDOC with the troubling statement that, *"Licensees are expected to review and consider guidance; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements."* This is not reasonable. Guidance is meant to be guidance. If a licensee is required to meet guidance criteria, then it is a requirement, not guidance. This is an important distinction and a recurring theme in all recent REGDOCS that I strongly urge the CNSC to address.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 30 on preface language.
40	Preface	J Froats	Traditionally Regulatory documents set requirements as to 'What' is to be done with guidance about how separated. o Statements like: •The Licensee of the NPP shall have a process of measurement in place to warn of cultural weaknesses that influence the likelihood of future safety significant events. Measurements may include feedback from safety culture assessments, safety oversight entities, external reviews, backlogs and so on. •The Licensee shall reflect the importance of a positive safety culture in the recruitment, appointment and performance of executives whose role has a strong influence on the attitudes and beliefs of the organization may be more of the kind of Regulatory requirement level than the current content. I would suggest that respect and understanding for the design basis of the facility needs to feature as one of the elements.	While comments are acknowledged, no changes to the REGDOC were suggested. CNSC staff acknowledge the importance of accurate risk recognition by a facility's management team. Although not explicitly captured in this REGDOC, the CNSC framework has other provisions that capture the importance of addressing risks (e.g. sufficient number of qualified staff, managing worker fatigue) as well as strong provisions for a robust problem identification and resolution system. These are outside the scope of the proposed REGDOC See comment 19 on the balance of information and requirements.
41	Preface	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Referring to existing facilities, the draft says, "The requirements contained in this document do not apply unless they have been included, in whole or in part in the licence or licensing basis." What is the intent of this statement? Can it be interpreted that this REGDOC applies or does not apply to existing facilities? Does this mean it only applies after relicensing changes? It this applicable to Nuclear Waste facilities?	The REGDOC was modified as a result of comments provided. The CNSC will be providing further clarity concerning guidance through REGDOC 3.5.3, *Regulatory Fundamentals*

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			Request for clarification	which will be made available at a later date. Requirements come into force once they are included in the licence and/or LCH (Compliance Verification Criteria section). See comment 1 on applicability of requirements. As stated in the *Class I Nuclear Facilities Regulations*: "Class IB nuclear facility means any of the following nuclear facilities: … (e) a facility for the disposal of a nuclear substance generated at another nuclear facility;" As identified in section 2, the requirement on fostering safety culture applies to all Class I facilities.
42	Preface	Cameco	As indicated in our previous submissions on discussion papers DIS-14-02, Modernizing the CNSC's Regulations and DIS-16-01, How the CNSC Considers Information on Costs and Benefits: Opportunities to Improve Guidance and Clarity, Cameco encourages the CNSC to take cost-benefit information into account when deciding to make changes to its regulatory framework. When CNSC uses REGDOCs instead of regulations to make regulatory changes, the CNSC should still meet the intent of the Red Tape Reduction Act and the One-for-One rule and ensure that for each administrative burden created, another burden is removed. For example, in Section 5, Potential Impacts, CNSC staff merely note, "The requirement to provide a summary report of safety culture assessments may result in a modest administrative burden on nuclear power licensees" without identifying a corresponding offset to the new administrative burden.	While comments are acknowledged, no changes to the REGDOC were suggested. The CNSC's stance on cost-benefit information will be detailed in upcoming REGDOC-3.5.3, *Regulatory Fundamentals, Volume II: Considering Cost Benefit Information submitted by licensees*.
43	1. Introducti	CNL/SNC Lavalin/Bruce	The proposed CNSC definition of safety culture is technically sound in that it conveys a neutral stance to culture and can be either positive or negative in promoting certain	The REGDOC was modified as a result of comments

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	on	/ NB Power	outcomes. However, it differs from that of the various definitions industry uses and varies slightly between the Introduction and the Glossary. Was this intentional and can the definitions used by the industry continue? Where did the CNSC's proposed definition come from? As written, the definition in this paper is less useful as a communications tool to promote the importance of having a positive safety culture. The WANO/INPO (2012) and the IAEA (2006) definitions are more effective in this regard and would help give a sense to a workforce that safety takes precedence over competing goals. The CNSC's proposed definition also emphasizes a perception - 'the importance that the licensee places on safety' - rather than an attitude towards the importance of safety in the workspace throughout a licensee's organization and the role licensees play in promoting safety, safe practices, etc. Licensees suggest the CNSC adopt an existing, accepted international standard definition such as the IAEA or WANO/INPO definition of nuclear safety culture, which says: "Nuclear Safety Culture is defined as the core values and behaviours resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment." Major Adopting an existing internationally recognized definition would help foster a common international understanding of nuclear safety culture.	provided. The definition in the introduction and in the glossary are now identical, and define safety culture as follows: "the characteristics of the work environment, such as the values, rules, and common understandings that influence workers' perceptions and attitudes about the importance that the organization places on safety." Furthermore, text was added to the introduction to acknowledge other definitions in the nuclear industry. Minor variations in the definitions of the IAEA, WANO and CNSC, do not affect the requirements. All the safety culture definitions highlight similar elements and have similar goals.
44	1. Introduction	Bruce Power	Establish a common understanding of what constitutes a healthy safety culture and the importance of fostering safety culture in a licensee's organization i. Adopt an existing, industry-accepted definition of safety culture for consistency, simplicity and more effective communications. The CNSC's proposed definition of safety culture as "the characteristics of the work environment, such as the values, rules and common understandings that influence workers' perceptions and attitudes about the importance that the licensee places on safety" is	While comments are acknowledged, no changes to the REGDOC were suggested. In the interest of creating a common understanding, the CNSC has conducted extensive consultation for this REGDOC. The CNSC has been active in this area since the mid 1990s when Organizational & Management (O&M) assessments were conducted at 12 licensees including all nuclear power plants.

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			technically sound. However, it's less effective as a communications tool as either the WANO/INPO (2012) or IAEA (2006) definitions. For consistency and simplicity, Bruce Power favours the WANO/INPO definition, which describes nuclear safety culture as "the core values and behaviours resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment." This definition emphasizes the importance of safety above all and is familiar and widely-accepted by the global nuclear industry.	Since then CNSC staff have continued to seek a common understanding through the following engagement activities: 2004 – Safety culture (SC) symposium 2012 – Discussion Paper DIS-12-07 'Safety Culture for Nuclear Licensees' and What We Heard Report 2014 – Meeting with the Candu Owners' Group 2016 – Stakeholder workshop 2017 – 2 Stakeholder workshops (January and June 2017)
45	1. Introduction	Cameco	The neutral definition of safety culture proposed in the REGDOC is inconsistent with the definitions used by the IAEA and the United States Nuclear Regulatory Commission (NRC), which both include two essential elements of nuclear safety culture: 1) safety takes priority over competing goals of an organization; and, 2) safety is a shared responsibility. Instead, the REGDOC incorporates these two elements as requirements of a healthy safety culture while adopting the IAEA safety culture framework based on the IAEA definition of safety culture. In our view, the neutral definition offers no advantage over the IAEA and NRC definitions and creates unnecessary confusion. For example, the REGDOC requires licensees to "document their commitment to fostering safety culture…" when, in fact, the intention is to foster a positive safety culture or a safety culture as defined by the IAEA and the NRC. Another deficiency in the proposed definition is that it restricts the meaning of safety culture to what workers perceive and not to what individuals actually do. This omission of behaviours in the definition is contrary to many of the characteristics of a healthy safety culture listed in Section 2 of the REGDOC and is contrary to the definition of security culture proposed in the REGDOC. For this reason, we believe that the NRC definition (and the WANO definition) better reflects the meaning of safety culture as used throughout the REGDOC and should be adopted, being: Safety culture is the core values and behaviours that resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment."	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 43 on multiple safety culture definitions.

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46	1. Introduction	SNC-Lavalin	SNC-Lavalin Nuclear recommends that the CNSC document the difference between Nuclear Safety Culture and Safety Culture to provide greater clarity for application to non-power reactor licensees, whose nuclear safety risks are significantly lower.	The REGDOC was modified as a result of comments provided. Text was added to the introduction to state safety culture is standard terminology for many industries. Text was added to state safety culture is holistic, inclusive of, but not restricted to, occupational health and safety. Safety culture is more comprehensive than Occupational Health and Safety. In the Safety and Control Area framework which guides all CNSC licensee activities, Safety Culture and Occupational Health and Safety are recognized separately. Safety culture is seen to be more comprehensive than an explicit focus on worker safety in terms of availability and use of personal protective equipment, signing areas that are subject to slips, trips and falls, and holding handrails. These are important, but do not represent concepts such as decision making throughout the organization, communication, teamwork and continual learning, which are aspects of safety culture. Current use of the term "safety culture" has deep historic roots in post-Chernobyl follow-up actions and analysis published via international nuclear safety organizations (ie. INSAG-4, INSAG-15, IAEA GS-R-3, GSR Part 2, TECDOC 1707, NEA Governance, etc.) Continued use of the term "safety culture" remains as an

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				industry standard term for communicating the content of this document. For internal communications, licensees are free to use the phraseology they believe most appropriate for their organization.
47	1. Introduction	CNL, OPG, Bruce, NB Power	The document makes no specific mention of 'nuclear safety culture,' opting instead for the more generic 'safety culture.' Without specifying 'nuclear,' the document does not recognize the industry's unique nature or that safety culture, in a nuclear context, has an enhanced focus beyond industrial or occupational safety. Licensees urge the CNSC to add 'nuclear' to all references of safety culture. For additional clarity, industry suggests the document be amended as follows: In Section 1, Introduction, Para 1, Add: "For further certainty, it is expected that licensees ensure management and workers understand the higher-level obligations for nuclear safety over that of a conventional work environment." Major This document will be read and interpreted by members of the public who may not have a full awareness of the special and unique aspects of nuclear. Given this, the language must be particularly clear and not combine or confuse terminologies. Readers must understand that safety matters being discussed are not explicit to conventional safety, which could lead to misinterpretation of other Acts and regulations pertaining to occupational safety matters. Without a clear emphasis on nuclear safety culture, results of assessments could also be overly focused on conventional safety.	The REGDOC was modified as a result of comments provided. See comment 46 on safety culture definition. Text was added to state safety culture is holistic, inclusive of, but not restricted to, occupational health and safety.
48	1. Introduction	SNC-Lavalin	The document makes no specific mention of 'nuclear safety culture,' opting instead for the more generic 'safety culture.' Without specifying 'nuclear,' the document does not recognize the industry's unique nature or that safety culture, in a nuclear context, has an enhanced focus beyond industrial or occupational safety.	The REGDOC was modified as a result of comments provided. See comment 46 on safety culture definition.

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			Licensees urge the CNSC to add 'nuclear' to all references of safety culture. For additional clarity, industry suggests the document be amended as follows: In Section 1, Introduction, Para 1, Add: "For further certainty, it is expected that licensees ensure management and workers understand the higher-level obligations for nuclear safety over that of a conventional work environment." This document will be read and interpreted by members of the public who may not have a full awareness of the special and unique aspects of nuclear. Given this, the language must be particularly clear and not combine or confuse terminologies. Readers must understand that safety matters being discussed are not explicit to conventional safety, which could lead to misinterpretation of other Acts and regulations pertaining to occupational safety matters. Without a clear emphasis on nuclear safety culture, results of assessments could also be overly focused on conventional safety.	
49	1. Introduction	NB Power	NB Power believes and recognizes that Nuclear Safety Culture is the overriding priority and the document does not address the uniqueness of the nuclear industry for Nuclear Power plants. • NB Power recommends documenting the difference between Nuclear Safety Culture and Safety Culture because there is a fundamental difference between the two based on previous assessments results.	The REGDOC was modified as a result of comments provided. See comment 46 on safety culture definition.
50	1. Introduction	Canadian Nuclear Workers Association	The CNA recommends that the CNSC document the difference between Nuclear Safety Culture and Safety Culture to provide greater clarity for non-power licensees whose risks are significantly lower**.**	The REGDOC was modified as a result of comments provided. See comment 46 on safety culture definition.
51	1. Introduction	OPG	OPG does not support adding security culture to our framework at this time when we need significant operational focus, and we believe it will add a greater burden to OPG without a commensurate safety improvement. OPG believes that this new topic of Security Culture is immature and requires further consultation before requirements are established. OPG requests significant time before Nuclear Safety Culture and Security Culture are integrated	The REGDOC was modified as a result of comments provided. CNSC staff believe that security culture is a component of safety culture and security culture concerns can be effectively

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			to allow time to learn more about the industry developments in this area, which traits of a security culture are most important to measure, and to plan for their future integration with our employee education and self-assessment methodology.	mitigated within the broader safety culture framework. However, the REGDOC text was revised to clarify the relationship and to address stakeholder concerns. The following changes were made to text in the REGDOC: In the introduction, the text now reads: "Regulatory document REGDOC-2.1.2, Safety Culture, sets out requirements and guidance for fostering a healthy safety culture and for conducting safety culture assessments. It does the same for security culture. It is important to recognize that both nuclear safety and security and their cultures share the same overall objective, which is to limit the risk resulting from nuclear substances and associated facilities. The two cultures coexist and reinforce each other." In the introduction, the text now reads: "The CNSC defines security culture as the characteristics of the work environment, such as the values, rules, and common understandings that influence workers' perceptions and attitudes about the importance that the organization places on security." In section 3.2 (formerly 3.3.2), the text now reads: "Safety and security are integrated goals for any nuclear facility. Although safety and security culture assessment methods are generally similar, a security culture assessment places additional emphasis on mitigating the risk (likelihood and consequences) of deliberate malicious acts. As a result, the comprehensive safety culture reference framework

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				(Appendix A) has three indicators specific to security culture: the belief of a credible threat, employee screening practices and ensuring sensitive information is classified and controlled. While safety culture assessments could simultaneously assess security culture, licensees may choose to undertake independent assessments to assess security culture." A rationale for the inclusion of safety culture is included in the attached Disposition Appendix 1: Inclusion of Security Culture.
52	1. Introduction	OPG	Further consultation is required in order to understand the commission's intent related to all areas of safety culture including what is meant by security culture.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 44 on consultation engagement activities.
53	1. Introduction	OPG	In summary, OPG's most significant comments are: the inclusion of Security culture assessment is pre-mature at this time;	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 51 on the inclusion of security culture.
54	1. Introduction	CNL/SNC Lavalin / OPG / Bruce, NB Power	Shaping and influencing culture is primarily an act of leadership, not workers. However, the introduction of this draft indicates all workers have a shared responsibility to ensure a healthy safety culture is a priority. While this may be true in principle, in practice a healthy culture is fostered when leadership makes it a priority. Workers do not always have the means or ability to ensure a healthy nuclear safety culture is a corporate priority or to influence values and rules or the importance placed on safety by the licensee. Industry suggests emphasizing how leadership, not workers, shape culture in future drafts of this REGDOC.	The REGDOC was modified as a result of comments provided. The following wording was added to section 1-Introduction "All workers, from senior managers downwards, have a shared responsibility to ensure that a healthy safety culture is a priority…. A healthy safety culture is an interpretation of how safety is integrated into everyday work and interactions, rather than a program to be managed. It is reinforced in how people,

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			Major As currently written, this creates confusion as to the meaning of nuclear safety culture	including leadership, work together to create a deeper understanding of safety. "
55	1. Introduction	CNL/ SNC Lavalin/ OPG/Bruce, NB Power	Point #3 under section 1 says, "Safety culture is complex and constantly changing." However, licensees believe the CNSC more accurately describes this sentiment in the third paragraph of page 10 when it says nuclear "safety culture can change over time …" Rewrite the point to say, "Safety culture is complex and ~~constantly changing~~ changes over time." Major As currently written, the phrase 'constantly changing' might erroneously equate to 'constant monitoring', which would add an administrative burden to licensees with no appreciable impact on nuclear safety culture	The REGDOC was modified as result of comments. The following wording was changed in Section 1 - Introduction "Principal 3. Safety culture is complex and changes over time."
56	1.1 Purpose	J Froats	The DRAFT REG DOC rightly points out that the CSA N286-12 Management Standard that is the basis document for the Quality Management Program at Canadian NP P's (once referenced in the Licence or Licence Condition Handbook). So, to some degree, the REG DOC is a duplication of the requirement to have a Safety Cultural element as part of the overall managed system. I think there is general agreement that the cultural elements of an NPP need to be built in, rather than 'bolted on' - which tends to favour embedding activities in the core programs to enhance Safety Culture, rather than adding an additional program. It is not clear to me as a reviewer, what the intent (drivers) for this document are given there already appears to be a Regulatory requirement established via the CSA N286 Standard being imbedded in the Licencing of NPP's in Canada. The current document has pieces of what appears to be at least three separate objectives: • Establish Regulatory Requirements for a management program that promotes a 'Healthy Safety Culture' • Establish an approach (guidance) for the specific tool of safety cultural surveying • Provide some guidance for Regulatory evaluation of a management program's influence	The REGDOC was modified as result of comments. The REGDOC has text explaining that fostering safety culture provides context to the N286 requirements on safety culture: "This document provides more specific requirements and guidance related to safety culture, as an elaboration on the management system requirements contained in the CSA standard CSA N286, *Management system requirements for nuclear facilities*". In developing REGDOCs, CNSC staff remains cognizant of any and all applicable standards including those produced by the CSA Group and work to ensure minimal duplication of information. As well, the CNSC's active role in the development of CSA standards militates against duplication

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			on a 'Healthy Safety Culture' I think it would benefit from a clear objective that reviewers could use to guide their review.	and overlap. In addition, the publication of REGDOC 2.1.2 will help ensure that any future CSA standards concerning safety culture are aligned with established regulatory requirements.
57	1.1 Purpose	J Froats	The document provides an index of links to other existing information on the subject of safety culture and then moves to spend the majority of the DRAFT REGDOC-2.1.2, focusing on the single element of Safety Culture Assessments, which is only one small portion of a set of input information needed to assess adequacy of the safety culture at a facility. In fact, some of what is written in the current version on the subject of safety culture assessment methods seems to be more of a guide to CNSC staff for evaluating programming rather than a set or requirements for the programming itself. It is my view that there is a need to capture a clear set of Regulatory Requirements (or maybe just expectations). It is also my view that the document needs some further work to focus the content on a clear goal before it is ready to enhance clarity in this area.	The REGDOC was modified as result of comments. The requirements were clarified and now state: "Licensees shall document their commitment to fostering safety culture in their governing documentation. Licensees shall conduct comprehensive, systematic, rigorous safety culture assessments at least every five years." CNSC is committed to fostering licensees' engagement in a healthy safety culture within their respective organization. The document is meant to provide information and guidance to all licensees with specific requirements for nuclear power plants. Special attention was given to safety culture assessments due their relative importance in fostering a healthy safety culture. This requirement applies only to NPPs. For further information concerning the scientific basis for the requirements for the REGDOC, including safety culture assessments, please see the attached Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2, *Safety Culture*.

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58	1.2 Scope	Areva	Scope – Section 1.2 requires rewording to clarify applicability of Section 2 to nuclear power plants.	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements.
59	1.2 Scope	SNC- Lavalin	However, for non-power reactor licensees, guidance may be needed to inform these licensees on how to meet the requirements. To be most useful to non-power reactor licensees, could the CNSC revise the guidance to provide direction on a graded approach for a safety culture program, and include some examples?	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements.
60	1.2 Scope	Nordion	It is felt that this document does not clearly describe how this would apply to Class 1B facilities;	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements.
61	1.2 Scope	Canadian Nuclear Workers Association	The CNSC should modify the document to have a very clear graded approach for different types of licensees. Failure to do so could result in undue burden on non-NPP facilities where the regulatory requirements are unclear**….**As outlined previously, our members do not believe in the "one size fits all" approach.	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements.
62	1.2 Scope	Jeff Dovyak Winnipeg Health Authority	The current proposed scope seems reasonable, in my opinion it would be unreasonable to expand the scope of this REGDOC to apply to Nuclear Substances and Radiation Devices licences or Class II Nuclear Facility licences. Most healthcare institutions that I am familiar with do not have the resources to plan, assess, evaluate and report on Safety Culture every three years and some may even struggle to explicitly foster Safety Culture. We recently saw in the draft *Regulatory Oversight Report on the Use of Nuclear Substances in Canada: 2015* that exposures to workers are relatively low and the majority of exposures do not approach a dose limit (member of the Public **or** Nuclear Energy Worker) and that 96% of reported events have been categorized at INES level 0. My concern is that there may be a faction within CNSC staff that embrace this REGDOC to the extent that they feel it should be applicable to Nuclear Substance and/or Class II Nuclear In closing, I do not believe that there is currently a reasonable justification to expand the scope of Draft REGDOC-2.1.2 such that it would be required for Nuclear	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 1 on applicability of requirements. NSRD and Class II licensees have no formal requirements in the REGDOC.

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			Substances and/or Class II facilities licences.	
63	1.2 Scope	AREVA	Requires rewording to clarify applicability of Section 2 to nuclear power plants.	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements. As mentioned in section 2 of the REGDOC, the requirement to foster safety culture is applicable to all Class I licensees and UMM.
64	1.2 Scope	AREVA	The international standards developed by the IAEA which form the basis of the REGDOC are primarily focused on nuclear power plants (NPP). While safety culture characteristics and evaluation methodologies for uranium mines and mills (UMM) and NPPs may have commonalities, the REGDOC has provided flexibility to UMMs by limiting the scope of UMM requirements to Section 2, and offering the remaining content of the REGDOC as available guidance which may be applied using a graded approach	While comments are acknowledged, no changes to the REGDOC were suggested.
65	1.2 Scope	J Froats	It would appear that Appendix A is intended to establish requirements - requirements might better be clearly established in the front of the document.	The REGDOC was modified as result of comments. Appendix A was removed. See comment 1 on applicability of requirements.
66	1.3 Relevant Legislation	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Relevant legislation also includes the Nuclear Non-Proliferation Import and Export Controls Regulations (NNIECR). Add paragraphs 1(1), (2), (3) and (4) of the NNIECR: 1 (1) The definitions in this subsection apply in these Regulations. *Act* means the Nuclear Safety and Control Act *Controlled nuclear equipment* means the controlled nuclear equipment and the parts and components for controlled nuclear equipment referred to in the schedule. *Controlled nuclear information* means the controlled nuclear information referred to in the schedule. *Controlled nuclear substance* means a controlled nuclear substance referred to in the	The REGDOC was modified as result of comments. Modified as suggested with formatting corrections.

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			schedule. *Transit* means the process of being transported through Canada after being imported into and before being exported from Canada, in a situation where the place of initial loading and the final destination are outside Canada. (transit) (2) All controlled nuclear substances are prescribed as nuclear substances for the purpose of paragraph (d) of the definition nuclear substance in section 2 of the Act, with respect to the import and export of those substances. (3) All controlled nuclear equipment is prescribed equipment for the purposes of the Act, with respect to the import and export of that equipment. (4) All controlled nuclear information is prescribed information for the purposes of the Act, with respect to the import and export of that information, unless it is made public in accordance with the Act, the regulations made under the Act or a licence. **Major** The draft is incomplete and does not address relevant essential regulations essential for the implementation of this proposed REGDOC. While the NNIECR does not specify any requirements for safety culture, the handling and use of the controlled nuclear equipment and controlled nuclear information does fall within safety culture through the other regulations cited in REGDOC-2.1.2. There is a linkage to the nuclear suppliers via the specification of nuclear equipment and services for Canadian licensees, where the nuclear suppliers are outside of Canada. The procurement of nuclear equipment and nuclear services from outside of Canada by Canadian licensees falls within the safety management programs that the licensees maintain for their licensed activities.	
67	1.4. Relevant national and internatio nal	Cameco	Editorial Clarification IAEA document GS-R-3, The Management System for Facilities and Activities referred to in Section 1.4 was superseded in June 2016 by GSR Part 2.	The REGDOC was modified as result of comments. GS-R-3 and GS-G-3.1 were removed from the document, and GSR Part 2 *Leadership and Management for Safety* was added.

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	standards			
68	1.4. Relevant national and international standards	Bruce Power	ii. It is premature to integrate nuclear safety culture and security culture into a single REGDOC. This draft cites a number of IAEA documents related to nuclear security even though the IAEA continues to develop guidance on assessment of nuclear security culture, including frameworks and assessment methodologies. We know that collaborative international efforts are underway in this area and licensees are proactively exploring ways to assess aspects of nuclear security culture using draft IAEA documents and industry expertise. However, it is simply premature to introduce security culture into a REGDOC at this time. While there is overlap at a between nuclear safety culture and nuclear security culture, the frameworks for assessing and understanding culture for safety and culture for security are at very different levels of maturity and development. The industry has had 30 years to develop a common language, common understanding and to mature the frameworks and assessment methodologies for safety culture, whereas similar concepts for security culture are in their infancy. Prematurely introducing requirements into a regulatory document could inadvertently, but effectively, stifle the collaboration and industry-wide learning necessary to mature the topic	The REGDOC was modified as result of comments. See comment 51 on the inclusion of security culture.
69	1.4. Relevant national and international standards	Cameco	Section 1.4 of the REGDOC recognizes that IAEA document SF-1, Fundamental Safety Principles underscores the importance of integrating safety and security. We note, however, that the scope of SF-1 emphasizes the integration of safety and security measures and not safety and security culture. None of the three principles in SF-1 relied on to support integration of safety and security culture refer to safety and security culture and Principle 3 specifically refers to security as "another requirement", in addition to safety, of a management system. While there is some overlap at a very high level between nuclear safety culture and nuclear security culture, the two have important differences that justify using separate regulatory documents for each. The first fundamental difference is the regulatory stage of development each has reached.	The REGDOC was modified as result of comments. See comment 51 on the inclusion of security culture.

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			The REGDOC cites a number of IAEA documents related to nuclear security. However, the IAEA has not yet published any guidance on nuclear security culture, including frameworks and assessment methodologies, although collaborative international efforts are underway to develop these. In contrast, the industry has had several decades to develop a common language for, and a common understanding of, safety culture and these have been used to develop the mature frameworks and assessment methodologies currently used by industry. Similar concepts for security culture are in their infancy and, while licensees are actively exploring ways to assess aspects of nuclear security culture using draft IAEA documents and industry expertise, it is simply premature to integrate security culture into this REGDOC. Doing so could stifle the ongoing evolution of the development of security culture through industry collaboration. The second fundamental difference is the basis and origins of each culture. As the IAEA Nuclear Security Culture Implementing Guide (2012) states, "…*both nuclear safety and nuclear security consider the risk of inadvertent human error, nuclear security places additional emphasis on deliberate acts that are intended to cause harm. Because security deals with deliberate acts, security culture requires different attitudes and behaviour, such as* *confidentiality of information and efforts to deter malicious acts, as compared with safety culture."* This difference means that individuals will not necessarily perceive common characteristics of safety culture and security culture in the same way. It also means that a particular facility could have a safety culture that is quite distinct from its security culture. In practice, this would make a combined safety and security culture assessment problematic; it would require significantly more effort (i.e. close to doubling the required assessment resources) because most questions would have to be probed from both a safety and security point of view. In addition, the REGDOC does not clearly demonstrate how a graded-approach for security culture would apply when security culture is treated as a component of safety culture. This is particularly important for a licensee such as Cameco whose licensed facilities security requirements differ considerably from the nuclear power plants and even between different	

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			Cameco operations. This is another aspect of security culture that needs further examination before mandating a specific approach. Since the REGDOC lists indicators that only apply to security culture and contemplates separate safety and security assessments (section 3.4.1) without identifying any advantages for treating security culture as a component of safety culture, Cameco strongly encourages the CNSC to remove references to nuclear security culture from this draft until industry-wide efforts in this area are further developed.	
70	1.4.1 Security Culture	CNL. OPG, Bruce, NB Power	In keeping with industry's recommendation to remove references to nuclear security culture at this time (see comment #16 – "Nuclear safety culture and nuclear security culture have important differences …"), delete the final line of the Introduction, which says: ~~"In this document, "safety culture" denotes safety culture and security culture collectively, except where a distinction is made."~~	The REGDOC was modified as result of comments. See comment 51 on the inclusion of security culture.
71	1.4.1 Security Culture	SNC Lavalin	Security Culture is new to the industry, since the concept was first introduced in the 2005 Amendment to the Convention on Physical Protection of Nuclear Material (CPPNM) as fundamental principle F. Now that the Amendment to the CPPNM has come into force (as of May 8, 2016), IAEA and Nuclear Industry experts are starting to develop the framework for Security Culture. As noted in INSAG-24, paragraph 15, "The global nuclear security regime is not as mature as the safety regime". Hence, Security Culture is in the infancy stage. SNC-Lavalin Nuclear recommends that Security Culture be removed from the document until it is further defined and some operating experience with implementation of Security Culture is obtained.	The REGDOC was modified as result of comments. See comment 51 on the inclusion of security culture.
72	1.4.1 Security Culture	NB Power	Security Culture is new to the industry where as Nuclear Safety Culture has had a decade or more to be defined and shaped into a practicable application which yields benefit. The IAEA and Nuclear Industry expert are only starting to develop the framework for Security Culture which is in the infancy stage. • NB Power recommends security culture be removed from the Regulatory Document until it is further defined by IAEA and INPO/WANO and known benefits have occurred at other stations	The REGDOC was modified as result of comments. See comment 51 on the inclusion of security culture.
73	1.4.1 Security	CNL	While industry believes it is premature to include nuclear security culture in this REG DOC, licensees clearly recognize the need for healthy nuclear security and nuclear safety	The REGDOC was modified as result of comments.

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	Culture		cultures. Nuclear safety culture and nuclear security culture have important differences and the models require maturation before mandating integration. • CNL **strongly encourages the CNSC remove references to nuclear security from this draft until industry-wide efforts in this area are complete.**	See comment 51 on the inclusion of security culture.
74	1.4.1 Security Culture	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Nuclear safety culture and nuclear security culture have important differences and the models require maturation before mandating integration. This draft cites a number of IAEA documents related to nuclear security. However, the IAEA has not yet published any guidance on nuclear security culture, including frameworks and assessment methodologies, although collaborative international efforts are underway to define them. While licensees are proactively exploring ways to assess aspects of nuclear security culture using draft IAEA documents and industry expertise, it is simply premature to introduce security culture into this draft REGDOC. The industry has had 30 years to develop a common language, common understanding and to mature the frameworks and assessment methodologies for safety culture, whereas similar concepts for security culture are in their infancy. Why does the CNSC believe the IAEA security culture requirements, which remain in development and are not well-established or understood, need to be blended into a very mature, well-established nuclear safety culture framework at this time? While there is some overlap at a very high-level between nuclear safety culture and nuclear security culture, they have fundamentally different basis and origins. As the IAEA Nuclear Security Culture Implementing Guide (2012) says, "…*both nuclear safety and nuclear security consider the risk of inadvertent human error, nuclear security places additional emphasis on deliberate acts that are intended to cause harm. Because security deals with deliberate acts, security culture requires different attitudes and behaviour, such as confidentiality of information and efforts to deter malicious acts, as compared with safety culture.* Even within this draft, the relationship between nuclear safety culture and nuclear security culture is described inconsistently: - 'Security culture is a major component of safety culture' (Introduction, Para 5); - 'Safety culture and security culture coexist and reinforce one another' (Introduction, paragraph 6);	The REGDOC was modified as result of comments. See comment 51 on the inclusion of security culture.

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			- '…healthy safety and security cultures have similar characteristics and indicators' (*page* 5, paragraph 4). Licensees strongly encourage the CNSC to remove references to nuclear security culture from this draft until industry-wide efforts in this area are more advanced. **Major** Prematurely introducing requirements into a regulatory document could inadvertently, but effectively, stifle the collaboration and industry-wide learning necessary to mature the topic.	
75	1.4.1 Security Culture	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	The second sentence in Section 1.4.1 does not explicitly consider the need to provide greater assurance of preventing, detecting, delaying and responding to theft, unauthorized access, illegal transfer, or other malicious acts involving prescribed information or prescribed equipment in use, storage, or transfer. Also, the term nuclear substance should be used, rather than radioactive material. Change second sentence in Section 1.4.1 to read: "This will provide greater assurance of preventing, detecting, delaying and responding to theft, sabotage, unauthorized access, illegal transfer, or other malicious acts involving a nuclear substance, prescribed equipment or prescribed information in use, storage, or transport." **Major** As written, the draft regulation is clear that nuclear security envelopes nuclear safety through the addition of the additional attribute (i.e., matters identified in *). In this regard, however, the draft regulation must be enhanced to the level of required continuity in use of language as that found in the family of the other Regulations and Acts.	The REGDOC was modified as result of comments. The second paragraph in Section 1.4.1 now contains: "This will provide greater assurance of preventing, detecting, delaying and responding to theft, sabotage, unauthorized access, illegal transfer, or other malicious acts involving a nuclear substance, prescribed equipment or prescribed information in use, storage, or transport."
76	1.4.1 Security Culture	AREVA	The CNSC has introduced Security Culture into the REGDOC without previous discussion on the topic, i.e. security culture was not presented for discussion in CNSC's "Discussion Paper DIS-12-07, Safety Culture for Nuclear Licensees" or any other document. • As this is a newly introduced topic, CNSC should be prepared to adapt REGDOC 2.1.2 based on comments received on nuclear security from stakeholders and provide a revised draft for comment, or remove Nuclear Security Culture entirely from this REGDOC.	The REGDOC was modified as result of comments. See comment 51 on the inclusion of security culture.

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			•CNSC should clarify that it is referring to nuclear security in a manner consistent with IAEA in all cases, i.e. security of radioactive material, to avoid misinterpretation with the common and broader understanding of the term security. •CNSC should clarify that Nuclear Security Culture aspects of Section 2 apply to facilities managing nuclear materials identified in Schedule 1, or facilities identified in Schedule 2, of the Nuclear Security Regulations. •Safety and nuclear security are less similar than indicated by the REGDOC. An organization may have different attitudes, management systems and evaluation methods for the prevention of accidents (safety) and prevention of deliberate malicious	
77	2.Fostering Safety Culture	OPG	The current framework that OPG uses, which is an industry standard model, was developed after years of learning and benchmarking and aligns to our current leadership tools and management system. We would be remiss if we were to just dismiss all of this learning for a new framework that does not align with the nuclear industry best practice. We also believe that 'one size does not fit all' and that recommending one framework with safety culture attributes does not allow different types of nuclear licensees to use the best framework adapted for their safety risk areas. As an example, having nuclear safety the overriding priority would not fit the medical industry where patient safety is paramount. In summary, the REGDOC should not be prescriptive as to the framework to be used. If CNSC chooses to propose a framework, the REG DOC should be clear that licensees may choose to use it but are not required to.	The REGDOC was modified as result of comments. See *Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2 Safety Culture* section 8 for more information on frameworks. The framework has been moved to Appendix A, and the framework is formally referred to only in section 3, safety culture assessments, 3.3.3 Assessment framework. Licensees are free to use the framework of their choice; However a systematic gap analysis may be requested to demonstrate the existence of all requisite components. For efficiency of review by CNSC staff, the framework which the licensees will be using should be mapped to the framework presented in the new Appendix A: Safety Culture Reference Framework of the document. This is clearly stated in the new Section 3.3.3.
78	2.Fosteri	Bruce Power,	Under guidance, the proposed safety culture reference framework is overly rigid and	The REGDOC was modified as result of comments.

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	ng Safety Culture	NB Power, OPG, CNL, SNC Lavalin	prescriptive. As currently written, this draft: 1) Utilizes characteristics which are not aligned to the 10 WANO/INPO Traits of a Healthy Nuclear Safety Culture currently used by many licensees. For instance, it refers to "questioning attitude," which in the traits includes "recognizing nuclear as special and unique." However, there is no characteristic in this REGDOC that supports this recognition. 2)Implies an expectation that licensees must, if not actually adopt the framework, at least explicitly address the details in the CNSC list. This interpretation is supported later in this draft by the final line of page 9, which says, "The licensee should be able to demonstrate that each characteristic in the CNSC's safety culture reference framework is clearly and effectively addressed." In subsequent drafts of this REGDOC, licensee's encourage the CNSC to: 1)A 2)A 1) Align the framework with the familiar, industry-accepted WANO/INPO traits and make it very clear this is simply an example framework that could be used to help licensees develop their own framework. This is already supported somewhat in the text by the phrase that calls the framework a "reference … for demonstrating a commitment to safety…" 3)S 2) State that licensee should have a detailed framework, but not require them to cover all the detailed points listed by the CNSC. **Major** Misalignment with the WANO/INPO traits will create an additional, non-value added burden to licensees rather than build on industry's current strengths in nuclear safety culture assessment. In addition, compelling licensees to use and/or address detailed safety culture characteristics that are currently listed in the CNSC framework but of limited applicability to their particular situation would only weaken the long-term viability of assessments.	See comment 77 on mapping frameworks.
79	2.Fostering Safety Culture	Cameco	The proposed indicators and characteristics listed in the safety culture reference framework are overly rigid and prescriptive. The REGDOC implies an expectation that licensees must, if not actually adopt the framework, at least explicitly address the details in the CNSC list. This interpretation is supported later in this draft by the final line of page 9, which says, "The licensee should be able to demonstrate that each characteristic in the CNSC's safety	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.

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			culture reference framework is clearly and effectively addressed." Cameco recommends that the REGDOC be revised to make it very clear the CNSC framework is simply an example one that could be used to help licensees develop their own framework. Further, the document should state that licensees should have a detailed framework, but not require them to cover all the detailed points listed by the CNSC.	
80	2.Fostering Safety Culture	NB Power	The term "guidance" is routinely used in the document; however the document, in many areas, makes inferences to where it is not guidance. For example, in the framework section it states "Licencees should ensure that the safety culture assessment framework is mapped against the five safety culture characteristics, and is used at all stages of the assessment process". At NB Power Nuclear, we have spent many years mapping our traits and using the INPO 12-012, Traits of a Healthy Nuclear Safety Culture. Mapping to new CNSC safety culture characteristics would add unwarranted costs to be passed on to the rate payers with no additional benefit. In addition, it would make it difficult to compare previous assessment results. NB Power recommends the document clearly states that other framework methodologies can be used to complete a Nuclear Safety Culture Assessment	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.
81	2.Fostering Safety Culture	OPG	The CNSC Assessment framework states "Licensees should ensure that the safety culture assessment framework is mapped against the five safety culture characteristics (section 2 of the document), and is used at all stages of the assessment process". OPG does not believe that changing our current framework to align with the proposed CNSC framework will improve Safety Culture at this time. A mapping of the CNSC Framework to the 10 Traits is provided in Attachment 2 and shows some attributes missing from the CNSC framework that we believe are important for ensuring a healthy nuclear safety culture.	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks. Great that licensee going above and beyond requirements.
82	2.Fostering Safety Culture	OPG	Mapping of Reg Doc Framework to INPO's 10 Traits of a Healthy Nuclear Safety Culture – a table of the perceived CNSC framework to the INPO traits – see E-DOCS-#5200874-HOPD_copy_of_#5200154-v1-REGDOC-2_1_2__OPG_public_consultation_comments – last page	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.
83	2.Fostering Safety	J Froats	The "safety culture reference framework" put forward in section 2 is an adaptation of a number of IAEA documents. INPO has had a framework available for several years (Traits	The REGDOC was modified as result of comments.

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	Culture		of a Healthy Nuclear Safety Culture) which is already used extensively. It is not clear that creating another version of framework is beneficial.	See *Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2 Safety Culture* section 8 for more information on frameworks, specifically 8.3, literature, which reveals the diversity of published safety culture frameworks. The CNSC framework has longevity, with its origins grounded in research undertaken in the 1990's. Additionally, it needs to be relevant to all licensees, not only nuclear power plants. As such, licensees are free to adopt whatever framework they choose (REGDOC section 3.3.3, last sentence), so as long the framework used is mapped to the CNSC framework. See comment 77 on mapping frameworks
84	2.Fostering Safety Culture	Canadian Nuclear Workers Association	Licensees should be able to use the best framework to fit their safety risk areas. …. The REGDOC should not be prescriptive with respect to the framework used. If the CNSC feels it must suggest a framework, the REG DOC should be clear that licensees may use it but are not required to do so.	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.
85	2.Fostering Safety Culture	OPG	In summary, OPG's most significant comments are: the need for flexibility for licensees to use established safety culture framework;	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.
86	2.Fostering Safety Culture	Canadian Nuclear Workers Association	CNA members have significant concerns with the attempt to integrate nuclear safety culture with nuclear security culture. While industry recognizes that there is overlap between the two, we believe that it is premature to attempt put the two in the same REGDOC. Nuclear Safety Culture has had several decades to develop a common understanding for frameworks and methodologies to mature. Nuclear Security Culture on the other hand is not nearly as developed. The CNA and its members believe that it is premature to include nuclear security culture in this document and that it should be removed until it is more clearly developed.	The REGDOC was modified as result of comments. See comment 51 on the inclusion of security culture.
87	2.Fosteri	Bruce Power,	The reference framework noted in section 2 says, "Everyone understands..." throughout the	The REGDOC was modified as result of comments.

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	ng Safety Culture	NB Power, OPG, CNL, SNC Lavalin	section. It is difficult to measure, "Everyone's understanding" Suggest it say, "Workers understand" to make it less prescriptive. Minor	Suggested change made.
88	2.Fostering Safety Culture	AREVA	"Complete and accurate information is provided to the CNSC in a timely and open manner". Suggest replacing "CNSC" in this sentence with "stakeholders" as an indicator of a healthy safety culture. CNSC is amongst a set of stakeholders benefiting from information sharing which may include provincial safety regulators, occupational safety committees, industry associations, partners, etc.	The REGDOC was modified as result of comments. Text modified to add, "CNSC, and other stakeholders as appropriate".
89	2.Fostering Safety Culture	Bruce Power	i. De-emphasize the link between documentation and fostering a nuclear safety culture. Bruce Power's management system already documents our commitment to nuclear safety. The expectation of this REGDOC is also established in our operating licence through the application of CSA N286, Management Systems for Nuclear Facilities. In fact, the most recent update of N286, which we are transitioning toward, explicitly says: Management shall use the management system to understand and promote a safety culture by: (a) issuing a statement committing workers to adhere to the management system; (b) defining and implementing practices that contribute to excellence in worker performance; (c) providing a means by which the business supports workers in carrying out their tasks safely and successfully, by taking into account the interactions between individuals, technology and the organization; and (d) monitoring to understand and improve the culture. Although governing documentation should include a statement of commitment making satety the overriding priority and forming a basis for promoting a healthy nuclear safety culture, it is not through documentation that culture will be influenced. Rather, it is leadership decisions, words and actions that shape culture. To overemphasize the role of documentation is counterproductive since it will influence a culture that relies too heavily	The REGDOC was modified as result of comments. The document was modified in Section 1 to acknowledge the overriding importance of leadership in fostering safety culture: "It is reinforced in how people, including leadership, work together to create a deeper understanding of safety." See comment 54 on the role of workers. See the attached Disposition Appendix: Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2 *Safety Culture* on the importance of documenting a commitment to fostering a healthy safety culture. See comment 56 on elaboration on N286-12.

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			on written rules, not leadership actions.	
90	2.Fostering Safety Culture	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	On Page 6, what is the meaning of the bullet, "Managers do not abuse authority to circumvent security*" as part of the safety culture framework? *Request for Clarification*	The REGDOC was modified as result of comments. The indicator was broadened, as this is not specific to security only.
91	2.Fostering Safety Culture	J Froats	I hope that you find the feedback useful to progress the important work in this area. This area of safety Culture is complex. To quote a colleague who I respect very much "Every action or inaction by leaders is what sets and reinforces culture - and thereby drives safety behaviors." So in the end, getting the right leaders with the right personal set of values and personal integrity has to be a key part of the answer.	While comments are acknowledged, no changes to the REGDOC were suggested. Focusing on "assessment or monitoring', recognises that leaders in an organisation have substantial influence on the organisation's safety culture. Understanding an organization's safety culture is the first critical step in allowing management to take actions to foster a healthy safety culture. It is important that senior management move beyond what "they think" about an organization's safety culture and to learn about its present state. Proper monitoring and self-assessment as described in the REGDOC is key to this learning process.
92	2.Fostering Safety Culture	Canadian Nuclear Workers' Council	In Nuclear Industry workplaces there are three different groups of workers. These groups consist of regular staff of which the majority are Unionized, Construction Trades which are Unionized, & non- unionized contactor staff. We submit that unionized workers normally have a better safety culture versus non – unionized workers. The reason for this is that Unions are very supportive of safety for their members and fully support workers that raise safety issues. Looking at regular full time workers. These workers in most cases have additional health & safety provisions in their collective agreements & workplace safety is a priority. These workers generally have a good safety culture but from time to time there are incidents where these workers feel intimidated into raising safety issues. Unionized construction workers are also very safety oriented and have the support of their Union when they raise safety concerns. These workers are normally hired through a Union Hiring Hall. Their time on the job varies on the type of project that they are working on so	The REGDOC was modified as result of comments. The following indicator was added to Appendix A, under the characteristic "A learning organisation is built around safety": Safety culture reference framework "Workers are encouraged and recognized for reporting concerns or suspicions, are free from reprisal, and feel that they have been heard when they voice issues."

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			each day of work they are working towards their last day for when the project is completed. As the work winds down there are layoffs. Some of our member unions have indicated that some of their members at times who raise safety concerns are the first to be laid off. This concern/threat naturally affects the safety culture. Non-unionized workers face a similar if not more serious situation when they raise safety issues. Fortunately, these types of incidents occur minimally but in reality do occur. We suggest that the above scenarios issue need to be addressed in **Section 2 Fostering Safety Culture.**	
93	2.Fostering Safety Culture	OPG	OPG supports and currently demonstrates this requirement, however further clarification is needed as it relates to all areas of safety and security. OPG believes that Nuclear Safety is the overriding priority for nuclear power plants; the draft regulatory document is silent on this point.	The REGDOC was modified as result of comments. See comment 46 on safety culture definition. See comment 51 on the inclusion of security culture. The framework in appendix A has a safety culture characteristic entitled "safety is a clearly recognized value".
94	3. Safety Culture Assessments	Bruce Power	Licensees shall conduct comprehensive safety culture assessments that are empirical, valid, practical and functional i. Give licensees the discretion to conduct nuclear safety culture assessments best suited to their unique culture, operations and location. The restrictive and empirical underpinning of this requirement risks the unintended consequence of undermining efforts to foster a healthy nuclear safety culture The expectation to conduct "comprehensive safety culture assessments that are empirical, valid, practical and functional 11 at least every three years, when combined with the recommended guidance in Section 3, will mandate an exercise concerned primarily with the gathering and analysis of data. Instead, it should foster a process of self-discovery and	The REGDOC was modified as result of comments. The requirement was changed to: "Licensees shall conduct comprehensive, systematic, rigorous safety culture assessments at least every five years." CNSC acknowledges there are various means of gathering and analyzing information regarding safety culture. Licensees have the flexibility to institute a system which best reflects their operational context, so as long as it is comprehensive, systematic and rigorous. The information that comprises the remainder of section 3

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			reflection, supported by innovation in methodology, sharing experience and engaging leaders in the creative act of fostering a healthy nuclear safety culture over the entire lifecycle of an organization. This initial draft has a limited view of nuclear safety culture assessment. Culture may be assessed through any number of means, including surveys, external reviews, performance metric analysis, event analysis, etc. Yet the proposed approach is rigid and emphasizes a cookie-cutter method against a static framework to ease comparability, using phrases like: observable facts; logical analysis; clear interpretation; comparative analysis over time; analysis is defensible and replicable; structure; validated, etc. In reality, culture is an act of discernment, with the development of insights influenced by history and context. Direct comparison from one period to the next, or one licensee to the next, is ill advised and can be misleading. For example, a reduction in results in the survey tool could be the result of a healthier, more self-critical organizational culture, rather than a decline in a 'commitment to safety.	outlines the phases of an assessment following the IAEA document Safety Repot Series 83, *Performing safety culture self-assessment*, whereby current best practice is described. The frequency was also modified as a result of suggested comments.
95	3. Safety Culture Assessments	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	The proposed requirement, when combined with the recommended guidance in this section, could potentially undermine the health of nuclear safety culture. As currently written, it will mandate an exercise which is concerned primarily with the gathering and analysis of data rather than fostering a process of self-discovery and reflection, supported by innovation in methodology, sharing experience and engaging leaders in the creative act of fostering a healthy nuclear safety culture over the entire lifecycle of an organization. This initial draft has a limited view of nuclear safety culture assessment. Culture may be assessed through any number of means, including surveys, external reviews, performance metric analysis, event analysis, etc. Yet the proposed approach is rigid and emphasizes a cookie-cutter method against a static framework to ease comparability, using phrases like: *observable facts; logical analysis; clear interpretation; comparative analysis over time; analysis is defensible and replicable; structure; validated, etc.* In reality, culture is an act of discernment, with the development of insights influenced by history and context. Direct comparison from one period to the next, or one licensee to the next, is ill advised and can be misleading. For example, a reduction in results in the survey tool could be the result of a	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.

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			healthier, more self-critical organizational culture, rather than a decline in commitment to safety. Licensees strongly believe the CNSC does not need to define how safety culture assessment is to be performed. That should be left to the discretion of the licensee, which may approach the assessment in a manner best suited to their own culture, operations and location. If guidance is offered in subsequent drafts, licensees urge the CNSC to deemphasize the restrictive and empirical nature of a nuclear safety culture assessment to protect the integrity of the assessments themselves. Major The restrictive and empirical underpinning of the regulatory expectations overemphasize the survey aspect of the assessment and could wrongly give an impression that culture is measurable from a quantitative perspective, rather than recognizing there is a significant qualitative or insight-driven aspect to the assessment. It risks the unintended consequence of undermining efforts to foster a healthy nuclear safety culture. It removes the desire from licensees to apply their creativity and identify assessment and improvement opportunities best suited to their unique organizations.	
96	3. Safety Culture Assessments	Canadian Nuclear Workers Association	CNA members support the requirement to conduct rigorous, periodic nuclear safety culture assessments but believe that licensees should be given the discretion to conduct nuclear safety culture assessments that are best suited to their particular site.	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.
97	3. Safety Culture Assessments	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	The statement, "the chosen assessment method and associated safety culture framework" implies that licensees can use a safety culture framework different from the one described in Section 2. Please clarify whether the continued use of the INPO model without revision meets the requirements? *Request for Clarification*	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.
98	3. Safety Culture Assessments	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	How does the CNSC plan to address changes resulting from international efforts between INPO/WANO, IAEA and the CNSC, when they are issued as a new common language framework later in 2017? What does the CNSC expect licences to do differently given they use the INPO Traits and Attributes that do not map explicitly to the CNSC's framework?	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.

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			Request for Clarification	
99	3. Safety Culture Assessments	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Why was this framework chosen over other proven frameworks that exist in the nuclear industry? *Request for Clarification*	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.
100	3. Safety Culture Assessments	Nordion	The requirement to conduct safety culture assessments at least every three years seems unnecessarily onerous;	The REGDOC was modified as result of comments. See comment 94 on assessment frequency.
101	3. Safety Culture Assessments	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	While the requirement says assessments **shall** be conducted at least every three years, the guidance indicates that, "Organizations engaged in complex work involving many interdependent workers and processes will benefit from comprehensive monitoring, which **can** include safety culture assessments." The 1st statement says assessments are mandatory, which seems to contradict the 2nd statement saying that safety culture assessments are an optional part of comprehensive monitoring. *Request for Clarification*	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.
102	3. Safety Culture Assessments	OPG	OPG believes that the CNSC should set expectations for an assessment process, and for periodic validation that the process a licensee uses is adequately capturing the culture of the organization, but not define the timeframe or methodologies to be applied. The CNSC should allow for creativity in its licensees and encourage continuous improvement, including in the area of cultural assessment, rather than tying licensees to a particular methodology	The REGDOC was modified as result of comments. See comment 94 on assessment frequency. See comment 77 on mapping frameworks.
103	3. Safety Culture Assessments	OPG	The guidance in section 2 is too prescriptive with respect to the framework mapping and the expectation in section 3 to conduct assessments that are 'empirical, valid, practical and functional' at least every 3 years. The additional effort that would be required from licensees to demonstrate our current Nuclear Safety Culture Assessments meet this guidance would detract from the higher priority tasks it takes to implement and foster a healthy nuclear safety culture.	The REGDOC was modified as result of comments. See comment 94 on assessment frequency. See comment 77 on mapping frameworks.

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104	3. Safety Culture Assessments	Cameco	As discussed above, the REGDOC proposes a safety culture assessment at a frequency of at least every three years. We believe this frequency is not practical or achievable when the full cycle of planning, conducting, analyzing and reporting on the assessment is considered. It also ignores the business needs and other priorities of licensees. Such frequent assessment may also overwhelm staff as one round ends; the next begins leading to complacency and disengagement with the assessment process. Cameco strongly recommends that the requirement should read "Safety culture assessments should nominally be conducted every five years."	The REGDOC was modified as result of comments. See comment 94 on assessment frequency.
105	3. Safety Culture Assessments	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	The requirement that, "Safety culture assessments shall be conducted at least every three years" is overly restrictive without reason. It is suggested that some flexibility be built into this section to allow for business needs to be considered in the planning process. Revise wording to: "Safety culture assessments should nominally be conducted every three years and shall be conducted at least once every five years." **Major** Licensees require flexibility and discretion to properly plan assessments. These are large projects which impact a licensee's business plan. Industry agrees that a 3-year cycle is nominal, but suggests some flexibility out to 5 years and some latitude with regard to scope, since an assessment for an entire organization may not always be required within that time frame. This is with the understanding that licensees are constantly evaluating safety culture through other means (i.e. corrective action processes, safety culture monitoring panels, daily leadership meetings, etc.)	The REGDOC was modified as result of comments. See comment 94 on assessment frequency.
106	3. Safety Culture Assessments	Canadian Nuclear Workers Association	The CNA views the requirement for a safety culture assessment to be conducted every three years to be overly restrictive. While a three-year cycle maybe desirable some flexibility needs to be built in to allow licensees to focus on the findings of previous assessments. A rigid three-year cycle runs the risk of the assessment becoming an exercise focused on the collection and analysis of data. Given that many of our members are constantly evaluating safety culture through other means, CNA believes the REGDOC should allow some flexibility.	The REGDOC was modified as result of comments. See comment 94 on assessment frequency.
107	3. Safety Culture	Bruce Power	Safety culture assessments shall be conducted at least every three years.	The REGDOC was modified as result of comments.

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	Assessments		Upon completion of a safety culture assessment, the licensees shall prepare a summary report for submission to the CNSC Consider a three-year cycle as nominal with an option for five years. We find this proposed requirement to be overly restrictive without reason. Licensees need some flexibility to plan assessments, which are large projects that impact business plans. We agree that a three-year cycle is nominal, but suggest some flexibility out to five years with the understanding that licensees constantly evaluate safety culture through other means (i.e. corrective action processes, safety culture monitoring panels, daily leadership meetings, etc.).	See comment 94 on assessment frequency.
108	3. Safety Culture Assessments	Cameco	For further clarity on the REGDOC, Cameco considers many of the additional demands in Section 3 to add little value to improving Cameco's safety culture, but would add significant cost and effort. As such, Cameco does not intend to adopt the guidance for the following aspects of Section 3: • Conducting safety culture assessments every 3 years • Impact analysis of improvement actions • Communication plan to external stakeholders • Use of a maturity model • Summary report for submission to the CNSC	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC. See comment 94 assessment frequency The Communication plan has been changed to focus only on licensees' internal stakeholders. The expectation for licensees to share info with external stakeholders has been rescinded. The applicability of the maturity model has been clarified. Appendix B: *Safety Culture Maturity Model* provides an overview of the various stages of maturity and is applicable to all licensees. Appendix C: *Safety Culture Maturity Model Indicators and Specific Behaviours*, applicable for Class II and Nuclear Substances licensees provides guidance on specific behaviours related to the three stages of maturity of an organization's safety culture.

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109	3. Safety Culture Assessments	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Is the methodology being used in Class 1 facilities appropriate for smaller licensees? What benchmarking was done to address the methodology for smaller licensees? *Request for clarification*	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements. See comment 108 on suggested applicability to Class II and Nuclear substance licensees. IAEA document INSAG-15, *Key Practical Issues in Strengthening Safety Culture* offers a more practical approach for the smaller licensee.
110	3. Safety Culture Assessments	Canadian Nuclear Workers' Council	The CNWC and our member Unions fully support Safety Culture assessments. Done correctly these assessments can identify gaps in the culture. **Independent Assessments** The CNWC supports these types of assessments but suggests that they are only required on an intermittent basis provided that the self-assessments are performed satisfactorily. The regulation should stipulate the frequency of independent assessments. **Self-Assessments** The CNWC supports these types of assessment provided the following conditions are met: - The worksite unions are allowed to appoint one or more representatives to the assessment team. - The majority of the team members are from worksite external to the workplace being assessed. - Discipline or contemplation of discipline will not form part of any recommendations. **Assessment team selection** The CNWC suggest the following wording: The overall team should reflect a balanced representation of the above, including consideration **shall include Union appointed representatives (where applicable), &** of worker demographics (age, gender, union representatives).	The REGDOC was modified as result of comments. The CNSC acknowledges the inclusion of Union members for safety culture assessments as good practice; however, it does not dictate how the licensee conducts assessments. The recent advice in SRS 83, *Performing Safety Culture Assessments* outlines the advantages and pitfalls of both types of assessments (independent vs self-assessment). Section 3.2m of the REGDOC also provides general information on independent assessments. See comment 23 on fear of reprisal. In section 3.3.1 (formerly 3.3.3), the text has been revised to: Team members should collectively have knowledge and experience in: • human factors and behavioural/social sciences • qualitative and quantitative methods for cultural

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				assessment • assessments of safety culture • various functional area specialties (e.g. security, workers both unionized and not unionized as applicable, operations, maintenance, corporate office staff, senior management) • technologies of the organization
111	3.1. Objectives applicable to safety culture assessment methods	Cameco	The proposed requirement that "Licensees shall conduct comprehensive safety culture assessments that are empirical, valid, practical and functional", when combined with the recommended guidance in this section, could potentially undermine the health of nuclear safety culture. As currently written, it will mandate an exercise that is concerned primarily with the gathering and analysis of data rather than fostering a process of self-discovery and reflection, supported by innovation in methodology, sharing experience and engaging leaders in the creative act of fostering a healthy nuclear safety culture over the entire lifecycle of an organization. While Cameco understands the need for rigorous assessments, the CNSC requirements seem to imply an overemphasis on quantitative and highly deterministic types of analysis. For example, it is expected that analysis is "replicable". This implies the same conclusions would be reached with a different team. This is an unrealistic expectation for an interpretive exercise like a safety culture assessment. Further, it is impractical, if not impossible, for a licensee to demonstrate. The assessment is supposed to be based on "observable facts"; however, safety culture assessments are more often based on perceptions and observations, which may or not be "facts". Further, the REGDOC states that "the method allows for comparative analysis over time". Direct comparison from one period to the next, or one licensee to the next, is ill advised and can be misleading. For example, a reduction in results in the survey tool could be the result of a healthier, more self-critical organizational culture, rather than a decline in commitment to safety. In summary, the CNSC should revise some of the language in this section that makes it clearer that a rigorous, but flexible approach to assessments is allowed.	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.

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112	3.1. Objectives applicable to safety culture assessment methods	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	What is the rationale for the prescriptive nature of the requirement for the safety culture assessments to be empirical, valid, practical and functional as described in the guidance? *Request for clarification*	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.
113	3.1. Objectives applicable to safety culture assessment methods	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	**Empirical** – Industry has concerns with the 2nd and 3rd bullets. How is it possible to make a nuclear safety culture assessment replicable? As written, it could be interpreted that the CNSC expects licensees to provide all information collected. How are observations objective? To what extent would licensees have to use a method that uses objective observations? Remove 2nd and 3rd bullet points **Major** Regarding the 2nd bullet point, industry does not want the information to be replicable to protect integrity of the assessments and the privacy of its participants. Licensees will not keep assessment data to assure workers it will be not used improperly or perceived to be held against them in any way.	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.
114	3.1. Objectives applicable to safety culture assessment	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	**Practical, -** Industry has questions around the meaning of the 1st bullet: "Information obtained from the assessment method is clearly recorded to allow logical analysis." Similar to the comment above, this could indicate the CNSC expects all information from the assessment to be recorded and provided to CNSC. Is this the intent? For the 2nd bullet, what is meant by demographics? Is it necessary, and is there value added, to collect demographic information? Why do licensees need to include job position? The current wording threatens the anonymity of the responses. *Request for Clarification*	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.

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	methods			
115	3.1. Objectives applicable to safety culture assessment methods	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	**Functiona**l – Industry has concerns with the phrase "observable facts" in the 1st bullet. What is meant by the 2nd bullet, which says, "The assessment yields relevant, actionable information"? Does the assessment also need to have actions? Replace the phrase "observable facts" with "based on observations and perceptions" in the 1st bullet and clarify the 2nd bullet. **Major** Industry relies heavily on the perceptions of workers who participate in assessment surveys and discuss nuclear safety culture with interview teams. Changing the assessment methodology from what licensees in both Canadian and US facilities currently and effectively use would require significant additional effort without a corresponding benefit to nuclear safety. Observable facts are more of a continuous monitoring data-gathering technique and not applied extensively during the three-year assessment.	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.
116	3.1. Objectives applicable to safety culture assessment methods	Canadian Nuclear Workers Association	The REGDOC requires safety culture assessments that are "empirical, valid, practical and functional". The CNA disagrees with this approach. We do not believe that it is practical or frankly desirable to try and develop a baseline and measure safety culture in empirical and comparable terms. Changes in safety culture can be discerned over time but it is best done through qualitative tools rather than trying to measure absolute quantifiable changes. The most important element of safety culture assessment is the ability to discern strengths and weaknesses and changes in safety culture which can allow leadership to identify areas for additional focus. Our members feel CNSC should de-emphasize the restrictive and empirical nature of the proposed REGDOC.	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.
117	3.1. Objectives applicable to safety culture	OPG	In summary, OPG's most significant comments are: we believe there is a problem with the CNSC assumption that safety culture can be measured in such an empirical quantitative way, and that assumes it is possible to compare between licensees and against previous assessments in a quantitative way;	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.

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	assessment methods			
118	3.1. Objectives applicable to safety culture assessment methods	Bruce Power	Bruce Power strongly believes the CNSC does not need to define how safety culture assessments are to be performed. That should be left to the discretion of licensees so they can approach an assessment in a manner best suited to their own culture, operations and location. If guidance is offered in subsequent drafts, we urge the CNSC to de-emphasize the restrictive and empirical nature of a nuclear safety culture assessment to protect the integrity of the assessments themselves.	The REGDOC was modified as result of comments. For their safety culture assessments, licensees are free to use the assessment methods they believe most appropriate for their organization, provided requirements are met.
119	3.1. Objectives applicable to safety culture assessment methods	OPG	Assuming safety culture can be measured once and then have future progress compared against an established baseline is not a practical approach. Although changes in culture can be discerned over time and insights as a result of those changes can identify changing areas of focus for leadership attention, it is not feasible to measure culture in empirical, absolute and comparable terms. Nuclear Safety Culture can be discerned using qualitative assessment tools, but it is best to gauge progress through leadership experience and insights, as opposed to trying to measure absolute quantifiable changes. The most important focus of safety culture assessments should be to obtain valid and descriptive insights about strengths and weaknesses and a sense of what is changing, along with its magnitude (qualitative) and direction. It is important to note that the focus on safety culture assessments should be to improve safety outcomes, rather than such a higher emphasis on empirical reproducible accuracy of measurement.	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.
120	3.1. Objectives applicabl	OPG	There is a level of implied prescription in the guidance on the contents of the 'overview of assessment results' which includes 'a description of the data and analysis for each finding'. This aspect of the requirement will require significant consultation.	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC.

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	e to safety culture assessment methods			
121	3.1. Objectives applicable to safety culture assessment methods	J Froats	Surveying can give some insights but is only one part of the data gathering and understanding.	The REGDOC was modified as a result of the comments. New sections 3.4 Data Collection and 3.5 Data Analysis were created, whereby the opening sentence to Data Collection reads: "The primary methods used in safety culture assessments are well established social science tools being document review, surveys, focus groups, interviews and observations." As well, the REGDOC was modified to recognize the importance of continual monitoring as a key activity in fostering safety culture. See comment 24 on continual monitoring.
122	3.1. Objectives applicable to safety culture assessment	OPG	OPG endorses the requirement to conduct rigorous, periodic nuclear safety culture assessments and believe we currently meet this requirement. However, there are some aspects of the Guidance that if required or expected as written would increase burden on the organization and change our current assessment methodology without a commensurate increase in safety. Examples are provided in Attachment 1	See comment 94 on assessment thoroughness.

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	methods			
123	3.2.Communications Strategy	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Licensees should not be expected to share information from a safety culture assessment with the public to protect the integrity of assessments and the privacy of their participants. Licensees need the freedom to be harshly critical of themselves to drive continuous improvement. Compelling public communication of results will inadvertently pressure licensees to ensure positive assessments through the setting of lower expectations. Licensees urge the CNSC to remove any references or implied requirements to communicate nuclear security assessment results with external stakeholders. How licensees opt to communicate their assessments should be a matter of choice in line with their existing communication strategies, which makes this guidance unnecessary. **Major** To be useful, nuclear safety culture assessments need to be open and expressed in language understood by licensees in the context of their internal business practices. Assessments need to be unfiltered so leadership can reflect upon and take actions on internal issues. Findings are based on the perceptions of workers steeped in the nuclear culture of being extremely self-critical, which is vital to continuous improvement but easily misinterpreted by those unfamiliar with the industry. There is significant danger that results would be misunderstood by the public and generate unwarranted angst without extensive education, which is not practical. External sharing of even high-level summaries creates the potential to sanitize reporting and ultimately lower the overall impact on nuclear safety.	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC. See comment 108 on communication plan.
124	3.2.Communications Strategy	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	This draft acknowledges that "for security culture, the communications plan must consider that some information is security sensitive" but also says "for the benefit of greater awareness, all aspects should be shared broadly even if this requires some incidents or lessons learned to be generalized." Licensees urge the CNSC to remove the statement from future drafts or, at a minimum, add the words "to the extent possible" to the statement. **Major** Sharing security information even in a broad sense would not only expose vulnerabilities, but could also result in public angst if improperly characterized. It is noted on Page 9 that "some expectations differ from a safety culture assessment, in areas such as information	The REGDOC was modified as result of comments. See comment 108 on communication plan.

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			sharing and communications." It is not clear what the CNSC is willing to consider different.	
125	3.2 Communications Strategy	CNL	Licensees should not be expected to share information from a safety culture assessment with the public to protect the integrity of assessments and the privacy of their participants. Licensees need the freedom to be harshly critical of themselves to drive continuous improvement. Compelling public communication of results will inadvertently pressure licensees to ensure positive assessments through the setting of lower expectations. • CNL suggests the CNSC remove any references or implied requirements to communicate nuclear security assessment results with external stakeholders. CNL has been and continues to support providing confidential briefings to the CNSC on safety culture results.	The REGDOC was modified as result of comments. See comment 108 on communication plan. See comment 3 on rescinding a summary report submission to the CNSC.
126	3.2.Communications Strategy	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Paragraph 4, 3rd bullet, can the CNSC clarify what is meant by "contractors"? Licensees utilize contractors in various forms and require clarity to ensure there is no misunderstanding as to the extent of application to third parties who support the licensee. *Request for clarification*	While comments are acknowledged, no changes to the REGDOC were suggested. The REGDOC defines worker as: "A person who performs work referred to in a licence. Note: Workers include contractors and subcontractors, as well as persons directly employed by a licensee."
127	3.3 Preparing for the safety culture assessment	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	The CNSC is providing inconsistent information as to what constitutes a nuclear safety culture assessment. Although licensees may use formal assessments tools described in section 3.3, this is not the only means of assessing the culture of the organization, which appears to be recognized in section 3.4. Licensees should be encouraged to review their performance and culture on an ongoing basis, respond to changes in metrics and positive and negative events, both internal and external. Remove Section 3.3. Section 3.4 provides sufficient direction for licensees to perform assessments. **Major** By defining a nuclear safety culture assessment in such a prescribed manner, the CNSC is hindering licensee's flexibility to meet expectations.	The REGDOC was modified as result of comments. Section 2.2 of the revised version has continual monitoring as part of fostering safety culture. Section 3 is now only about safety culture self-assessment. The text has been modified to improve clarity and emphasize the extent of the flexibility which the licenses have concerning the assessment team. The skills and knowledge required was clarified to state that the team collectively should have the attributes listed.
128	3.3.1 Assessment	Bruce Power, NB Power, OPG, CNL,	Industry has concerns with Section 3.3.1 of this draft, which says, "Licensees should ensure that the safety culture assessment framework is mapped against the five safety culture characteristics (section 2 of the document), and is used at all stages of the assessment	The REGDOC was modified as result of comments.

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	framework	SNC Lavalin	process." Licensees believe this is overly prescriptive and feel the regulator should not impose how an assessment is performed, what framework is chosen or how it is mapped against the regulatory framework. Some Canadian operators are actively engaged in the joint IAEA–WANO/INPO initiative to harmonize safety culture frameworks and believe this is counter to those efforts to use a common vocabulary in regard. Several licensees already use the INPO/WANO framework, which has been mapped against the IAEA Standard Framework, and would be willing to provide such a mapping of characteristics to the CNSC for future drafts of this REGDOC. It is unclear in the current version whether the CNSC expectation is for the assessment itself to be mapped back to the bespoke CNSC framework, which would be a level of effort that would not add value for licensees with mature programs. Remove Section 3.3.1. Section 3.4 provides sufficient direction for licensees to perform assessments. Alternatively, industry suggests the use of the five safety culture characteristics be optional for utilities that may not currently have anything in place. **Major** Given that some licensees already use INPO's 10 Traits of a Healthy Nuclear Safety Culture, licensees would have to restructure their assessment processes greatly to meet what this section's expectations. This draft document does say, in section 3.4.1, that, "The licensee should be able to demonstrate that each characteristic in the CNSC's safety culture reference framework is clearly and effectively addressed." This suggests that if licensees can prove their framework is effective, they can continue to use it. The quality of assessments will be preserved if licensees that already use the INPO traits continue to do so because the traits: are familiar to personnel; already integrated into existing frameworks; used by the NRC and other worldwide regulatory agencies; adopted to align with nuclear industries for benchmarking purposes; used in previous assessments allowing for direct historical (trend) mapping.	See comment 77 on mapping frameworks.

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129	3.3.1 Assessment framework	NB Power	The term "guidance" is routinely used in the document; however the document, in many areas, makes inferences to where it is not guidance. For example, in the framework section it states "Licencees should ensure that the safety culture assessment framework is mapped against the five safety culture characteristics, and is used at all stages of the assessment process". At NB Power Nuclear, we have spent many years mapping our traits and using the INPO 12-012, Traits of a Healthy Nuclear Safety Culture. Mapping to new CNSC safety culture characteristics would add unwarranted costs to be passed on to the rate payers with no additional benefit. In addition, it would make it difficult to compare previous assessment results. NB Power recommends the document clearly states that other framework methodologies can be used to complete a Nuclear Safety Culture Assessment	The REGDOC was modified as result of comments. The sentence has been deleted from the REGDOC. See comment 77 on mapping frameworks.
130	3.3.2. Independent and self-assessments	Power Workers' Union	The PWU also submits that the CNSC should continue to perform external safety culture assessments from time to time and to continue including workplace safety performance in their annual report on the safety of Canada's NPPs. These activities on the part of the CNSC would remain a valuable component of maintaining and improving safety culture at nuclear facilities.	While comments are acknowledged, no changes to the REGDOC were suggested. The CNSC does not routinely conduct external safety assessments. However, should circumstances warrant, CNSC staff reserves the right to perform a safety culture assessment on licensees.
131	3.3.3. Assessment team selection	Cameco	Section 3.3.3 has an extensive list of "should" statements that, in practice, will be virtually impossible to satisfy. For instance, the assessment team leader selection is too detailed and prescriptive, particularly for hybrid assessments. These responsibilities do not necessarily need to be completed by the team leader and often would not if they had an internal team lead. In addition, the combination skills and demographics for team members would be very difficult to meet. Cameco recommends that this section recognize that any team will be a compromise of number of potentially competing factors and skill sets among its members and revise the "should" factors to be considerations for choosing team members.	The REGDOC was modified as result of comments. See comment 27 on the guidance language. Text now reads (section 3.3.1): Team members should collectively have knowledge and experience in: • human factors and behavioural/social sciences • qualitative and quantitative methods for cultural assessment • assessments of safety culture

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				• various functional area specialties (e.g. security, workers both unionized and not unionized as applicable, operations, maintenance, corporate office staff, senior management) • technologies of the organization
132	3.3.3. Assessment team selection	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Licensees believe this section provides an extensive list of "should" statement that, in practice, will be virtually impossible to satisfy. For instance, the assessment team leader selection is too detailed and prescriptive, particularly for hybrid assessments. These responsibilities do not necessarily need to be done by the team leader and often would not if they had an internal team lead. Nor does this section state that an assessment team should include someone with knowledge and expertise in assessments of security culture, should that requirement not be removed from this draft as urged by licensees. Remove Section 3.3.3. Section 3.4 provides sufficient direction for licensees to perform assessments. Alternatively, the CNSC could: delete the detailed list of responsibilities and simply state that responsibilities for the team leader and members should be defined (recognizing that any team will be a compromise of potentially competing factors and skill sets among its members); revise the "should" factors, to "considerations" for choosing team members; add nuclear security culture to the list of qualifications for assessment team members. **Major** Industry needs flexibility to choose team members to conduct effective safety culture assessments.	The REGDOC was modified as result of comments. See comment 131 on team selection.
133	3.3.3. Assessment team selection	Power Workers Union	Assessments are best conducted in a manner that ensures their findings will have credibility with workers and the public and which draws upon all available expertise in the area, including that provided by workers and their representatives who have been intimately involved in the maintenance and improvement of health and safety at nuclear facilities form their inception. In this regard, it is important to note that the PWU and Ontario Hydro established an internal responsibility system to improve safety in Ontario Hydro's	The REGDOC was modified as result of comments. See comment 131 on team selection. In addition, security, workers both unionized and not unionized as applicable, operations, maintenance, corporate

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			generating facilities before the Ontario Occupational Health and Safety Act was even enacted. Indeed the Ontario Hydro IRS became a model for the OHSA. The PWU and it members therefore have many decades of experience in improving safety in electrical generating facilities, including nuclear facilities. The PWU is supportive of self-assessments as an added measure to existing systems in place to maintain and improve the safety culture in nuclear facilities, so long as Worker Representatives are full and equal Members of the assessment teams. The PWU has decades of experience in participating in both incident investigations and safety assessments, which are at least as critical and important to safety matters as a self-assessment would be. Union-appointed representatives have provided constructive input and expertise in those contexts and would do so in self-assessments, which would in part be an extension of the efforts to improve safety culture that are one purpose of incident investigations and safety assessments.	office staffs and senior management were added as examples of "various functional area specialties".
134	3.3.3. Assessment team selection	Nordion	The requirement "A safety culture assessment is generally a hybrid of these two types, using a blended team of independent contractors and workers who represent all areas of the organization" suggests that external contractors be used to comply with the requirements of this program. In many of the recent requirements from the CNSC there has been a tendency to require the use external contractors which has a significant financial burden to licensees.	The REGDOC was modified as result of comments. See comment 118 on assessment methods.
135	3.4 Safety culture assessment process	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	The draft identifies nuclear safety culture assessment as an ongoing process, but indicates assessments are to be conducted every three years which would make them periodic, repetitive events. The CNSC can provide clarity by removing the phrase, "'is an ongoing process" from future drafts. *Request for clarification*	The REGDOC was modified as result of comments. The revised REGDOC clarified the role of fostering safety culture, as explained in the new section 2.2 Ongoing monitoring of safety culture.
136	3.4.1 Plan the assessme	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	3.4.1 - Industry is concerned the CNSC is prescribing detailed safety culture characteristics, particularly with the final sentence on page 9, which says, "The licensee should be able to demonstrate that each characteristic in the CNSC's safety culture reference framework is clearly and effectively addressed." As earlier indicated, licensees believe it should be	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.

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	nt		acceptable to perform a one-time mapping of how the characteristics are related to the INPO Traits of a Healthy Nuclear Safety Culture, or other credible nuclear safety culture documentation. Replace the sentence with, "The licensee should be able to demonstrate that it addresses its own framework." **Major** It is important that licensees retain control of what it determines are the important characteristics of its own safety culture framework.	
137	3.4.3 Respond to the assessment and transition to action	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	**3.4.3 -** The document suggests that improvements following an assessment will lead to improvements in established policies and procedures. Not all improvements will change policy and procedures. Rewrite to say, "How a licensee chooses improvements following an assessment, and the commitment to implementing these improvements, should be consistent with the existing management system ~~and lead to improvements in established policies and procedures~~." **Minor**	The REGDOC was modified as result of comments. The sentence now reads (3.7): "How a licensee chooses improvements following an assessment, and the commitment to implementing these improvements, should be consistent with its management system and lead to improvements."
138	3.4.3 Respond to the assessment and transition to action	OPG	OPG believes that not many improvements will be changes in policy and procedures. Also, it would be difficult to explicitly describe expected results from corrective actions created to address findings as suggested by the regulatory document. OPG does ensure that the rigor and complexity of the actions taken as a result of findings are commensurate with risk to the organization.	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness. See comment 137 on improvements following assessments.
139	3.4.4. Evaluate progress and	J Froats	There is too much focus in the document on analysis of the survey results. While you will do some analysis to look for trends etc ... there is little benefit in performing several layers of analysis. It is only a perception survey and beyond a certain point, there is nothing to gain by more detail.	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.

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	impact on safety culture			
140	3.4.4. Evaluate progress and impact on safety culture	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	**3.4.4 -** A list of safety culture monitoring activities has been included in section 3.4.4, which states that, "Licensees should consider these monitoring activities when planning subsequent assessments." Change the word "should" to "may" and remove the reference to appendix B in the second paragraph of 3.4.4. **Major** Currently, industry does not use all of these monitoring activities. If it were to do so, it would require additional effort with no corresponding benefit to nuclear safety. Examples include: providing topic-based surveys; focus area surveys and follow up surveys; reflecting on formal and informal dialogue focused on safety between management and other workers.	The REGDOC was modified as result of comments. See comment 27 on the guidance language. See comment 135 on ongoing monitoring. Clarity was added and it was made explicit that Appendix B by splitting Appendix B into two appendices. Appendix B retained the high-level maturity model which can be used to help all licensees monitor change over time. The newly created Appendix C lists specific indicators and clearly states that it provides information for Class II and Nuclear Substances licensees. Appendix C is intended for Class II and nuclear substance licensees to engage in a safety culture self-reflection.
141	3.5. Record keeping	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	**3.5 -**The guidance on record keeping is too prescriptive and already covered by licensee management systems Remove the section on record keeping. **Major** This is conflicting and unnecessary guidance.	The REGDOC was modified as result of comments. The former section 3.5 has been rescinded. Suggestions for appropriate documents and records are listed in each subsection of section 3.
142	4.Summary Report	Canadian Nuclear Workers Association	1) Perhaps the strongest concern, the CNA has with the proposed REGDOC is the requirement to submit a written summary report (which includes "a description of data and analysis for each finding") to the CNSC. While we recognize the need for the CNSC to be briefed on safety culture assessments, we bel eve the current method of detailed confidential briefings serves that purpose.	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC.

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			2) Given that any written report will be open to Access to Information requests and the very high likelihood of the detailed findings being taken out of context by the public or other stakeholders, the CNA believes that this requirement will have a chilling effect on participants and in fact will be a detriment to safety culture. 3) A successful safety culture depends upon the willingness of employees to speak freely and directly about safety culture without the fear of having a negative impact on the nuclear industry. The current CNSC approach has helped promote safety culture as an effective management tool. The CNA feels very strongly that this proposed requirement is a step in the wrong direction and will undue much of those benefits and significantly weaken the utility of safety culture assessments.	
143	4.Summary Report	Cameco	The CNSC's current, non-intrusive approach to safety culture assessments has helped promote the assessment as an effective management tool, not a regulatory one. This has resulted in positive benefits like ongoing engagement from site management and open, honest internal discussions about nuclear safety culture. Should the perception of assessments be changed to simply "another regulatory report/requirement," complacency and disengagement from the assessment process will likely follow. A summary report will also compromise the validity and quality of the assessment because participant responses to surveys and interviews will be less candid, self-critical and forthcoming when a measure of confidentiality is perceived to be lost through any form of public scrutiny. In our view, the value of the assessment could be protected if the REGDOC encouraged licensees to provide the CNSC with their approach to the assessment and to provide a confidential briefing on the key themes and planned actions to ensure continuous improvement in fostering a healthy nuclear safety culture. In the end, Cameco recommends that the requirement to submit a summary report be removed.	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC.
144	4.Summary Report	OPG	OPG remains open to have the CNSC review the summary report and action plan and the CNSC have been invited to participate in the training of staff involved in assessments. However, OPG has significant concern with the detailed findings being taken out of context if they become available to the public or other stakeholders and believe this concern could hinder our ability to continue to receive open and honest input from our employees during	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC.

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			the assessment process. There is a risk that by sharing our detailed information, we would erode trust with our employees. Additionally, it is helpful to the leadership team to look at the raw data and analyze it. If OPG was required to share this information widely, we believe this could cause a 'chilling effect' on the willingness of employees to speak openly without fear of having a negative impact on the nuclear program, and ultimately lower the value of the assessment in contributing to valid improvement plan actions to improve safety	
145	4.Summary Report	Bruce Power	Protect the integrity of assessments and the privacy of participants by removing the requirement to submit summary reports. The requirement to submit a summary report to the regulator will negatively impact the validity and quality of future assessments because they will be open to Access to Information requests. This will have a chilling effect on participants, who may be less self-critical or forthcoming if they know their views will be summarized for the CNSC and the public. To its credit, the CNSC's current, non-intrusive approach has helped promote nuclear safety culture assessments as an effective management tool, not a regulatory one. This has resulted in positive benefits like ongoing engagement from site management and unfiltered, internal discussions about nuclear safety culture. Should the perception of assessments be changed to simply "another regulatory report/requirement," there is a real risk the utility of assessments will erode. Bruce Power strongly encourages the CNSC to remove this requirement. Licensees should instead be urged to provide the CNSC with their approach to the assessment and a confidential briefing on the key themes and planned actions to ensure continuous improvement in fostering a healthy nuclear safety culture.	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC. Text was added in section 3.4 noting the crucial importance of participant confidentiality in conducting safety culture assessments.
146	4.Summary Report	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Has the CNSC considered and understood the chilling effect on open, honest answers from licensee staff that is likely to result from requiring a detailed summary report be provided to the CNSC? Similarly, what considerations has the CNSC given to the impact of public communications on safety culture data collected from workers promised confidentiality to ensure they would be self-critical and fulsome during assessments?	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC.

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			Request for clarification	See comment 145 on participant confidentiality.
147	4.Summary Report	SNC- Lavalin	If the CNSC will require that licensees submit summary reports on safety culture, SNC-Lavalin Nuclear recommends that summary reports that the licensee prepares and submits to the CNSC regarding safety culture assessments take into consideration that proprietary and commercially sensitive information may be contained in the reports. Hence, there needs to be assurances of non-disclosure to third parties to provide confidence that these reports are handled with due attention to the security designations on the reports.	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC.
148	4.Summary Report	Cameco	Licensees should not be expected to share information from a safety culture assessment with the public for the same reasons as stated above for submitting summary reports. In addition, compelling public communication of assessment results could inadvertently pressure licensees to ensure positive assessments through the setting of lower expectations or create a potential to sanitize reporting and ultimately lower the overall benefit to nuclear safety. Further, there is significant risk that the general public could misinterpret the results of an assessment expressed in language understood by licensees and workers in the context of their internal business practices and based on perceptions of workers who understand nuclear culture and are being extremely self-critical. Any public disclosure of the results of assessments will compromise the integrity of the assessment and defeat the goal of continuous improvement. Cameco strongly urges the CNSC to remove any references or implied requirements to communicate nuclear security assessment results with external stakeholders. How licensees opt to communicate their assessments should be a matter of choice in line with their existing communication strategies, which makes this guidance unnecessary.	The REGDOC was modified as result of comments. See comment 108 on communication plan.
149	4.Summary Report	OPG	OPG feels that sharing security information, even in a broad sense, would not only expose vulnerabilities, but could also result in panic or confusion in the public domain sensationalized by the media. It is noted on page 9 however that "some expectations differ from a safety culture assessment, in areas such as information sharing and communications." It is not clear what the CNSC is willing to consider as acceptable differences.	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC. See comment 108 on communication plan.

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	Section	**Reviewer**	**Reviewer's Comment**	**Response**
150	4.Summary Report	NB Power	Although NB Power remains transparent to the CNSC in providing a high level overview for Nuclear Safety Culture, we believe preparing a written summary report, other than at the utmost highest level, may jeopardize the trust the employees have in sharing information that is deemed confidential. In addition, NB Power believes any information provided to the public has the potential to be taken out of context and as such may hinder the ability to receive honest information from station staff because we will erode the trust of our employees. The sharing of confidential information could actually impede the ability to receive the appropriate comments which are meant to help us improve Nuclear Safety Culture. •NB Power recommends removing all information being shared with anyone with the exception of providing the CNSC with the highest level overview of the Nuclear Safety Culture Assessment results.	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC. See comment 145 on participant confidentiality.
151	4.Summary Report	OPG	In summary, OPG's most significant comments are: the concern with a requirement to provide CNSC, and external stakeholders, with summary reports on the assessments.	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC.
152	4.Summary Report	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	The requirement to submit a summary report to the regulator will negatively impact the validity and quality of future assessments because they will become publically available through the *Access to Information Act.* There is a real risk that participants in future assessments will be less self-critical or forthcoming knowing assessment summaries will be publically available. The need to protect the integrity of peer reviews is precisely why WANO continues to ensure its assessments remain as confidential and effective learning tools for the industry. Remove the requirement to submit a summary report. Encourage licensees to provide the CNSC with their approach to the assessment, provide a confidential briefing on the key themes and planned actions to ensure continuous improvement in fostering a healthy nuclear safety culture. **Major** Licensees have conducted assessments in the past without submitting summary reports to the CNSC. It is highly likely that responses to surveys and interviews would be skewed	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC.

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	Section	**Reviewer**	**Reviewer's Comment**	**Response**
			once workers understand their responses are going to be summarized for the regulator and the public. This could have a negative effect on the validity of the assessments. The CNSC's current, non-intrusive approach has helped promote nuclear safety culture assessments as an effective management tool, not a regulatory one. This has resulted in positive benefits like ongoing engagement from site management and open, honest internal discussions about nuclear safety culture. Should the perception of assessments be changed to simply "another regulatory report/requirement," there is a real risk the utility of the assessments will erode. Ensuring a measure of confidentiality in the results is important to preserve continued open and self-critical reflection.	
153	4.Summary Report	SNC- Lavalin	SNC-Lavalin Nuclear supports conducting periodic nuclear safety culture assessments. However, the framework needs to fit with our business needs. Furthermore, the frequency for conducting nuclear safety culture assessments should be flexible to allow us to adjust to our overall business cycles	The REGDOC was modified as result of comments. The requirement for safety culture assessment does not apply to this particular licensee. See comment 1 on applicability of requirements. See comment 19 on the balance of information and requirements. See comment 94 on assessment frequency.
154	4.Summary Report	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	The 3rd bullet says, "the chosen assessment method and associated safety culture framework." This implies that a licensee can use a safety culture framework different than the one described in Section 2. Please clarify. *Request for clarification*	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.
155	4.Summary Report	OPG	The description of improvement plan information contained in the guidance is also prescriptive and not very clear. For example 'improvement plans should discuss how the assessment findings are integrated with safety culture monitoring activities and the organization's processes and practices to improve safety.'	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC. See comment 141 on suggested documents and records for

Comments received during public consultation period September 26-November 28, 2016				
	Section	**Reviewer**	**Reviewer's Comment**	**Response**
				safety culture assessments.
156	4.Summary Report	OPG	There is a level of implied prescription in the guidance on the contents of the 'overview of assessment results' which includes 'a description of the data and analysis for each finding'. This aspect of the requirement will require significant consultation.	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC. See comment 141 on suggested documents and records for safety culture assessments.
157	4.Summary Report	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Please clarify the level of detail the CNSC requires in a summary report, particularly as it relates to a chosen assessment model? Is it acceptable to refer to a licensee's procedure and not outline/reproduce that procedure in a summary report? *Request for clarification*	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC. See comment 141 on suggested documents and records for safety culture assessments.
158	4.Summary Report	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Under guidance in Section 4 on the summary report, what is meant by, "The description of the safety culture assessment's goals should explain how the assessment supports organizational objectives. An overview of how the safety culture assessment relates to relevant organizational programs and practices should be included"? *Request for clarification*	The REGDOC was modified as result of comments. See comment 3 on rescinding a summary report submission to the CNSC. See comment 141 on suggested documents and records for safety culture assessments.
159	4.Summary Report	Nordion	It is Nordion's position that results of safety culture assessments should not be required to be shared with external stakeholders	The REGDOC was modified as result of comments. See comment 3 on summary report rescindment.
160	5. Appendix A: Applicabl	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	The draft REGDOC needs to ensure continuity with export and import license regulations. Import and export licences should be added to Table A1 as guidance **Minor** The procurement of nuclear equipment and nuclear services from outside of Canada by	The REGDOC was modified as result of comments. Table A1 has been rescinded from the document.

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	Section	**Reviewer**	**Reviewer's Comment**	**Response**
	e Requirements and Guidance, by Licence and Activity Type		Canadian licensees falls within the safety management programs that the licensees maintain for their licensed activities.	
161	5. Appendix A: Applicable Requirements and Guidance, by Licence and Activity Type	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Ensure consistency of language and intent between the main text and the appendix in the graded approach being adopted for some sections of the REGDOC. Delete the term "prudent management practice" as part of the descriptor to guidance in Table A1, as this erodes the notion that these sections are guidance and can be applied in a graded manner as is stated in Section 1.2. **Minor**	The REGDOC was modified as result of comments. Table A1 has been removed from the document.
162	6. Appendix B: Safety Culture Maturity Model	Bruce Power	i.Remove the safety culture maturity model described in Appendix B from any future drafts of this REGDOC. While we appreciate the CNSC's desire to offer context and guidance, this particular model is misaligned with the nuclear safety culture characteristics and poorly integrated with the draft REGDOC itself. The use of this model could create an environment where a licensee's culture is perceived as an absolute value that is simply pass or fail. In turn, this could inadvertently pressure licensees to meet fixed culture score requirements rather than	The REGDOC was modified as result of comments. See comment 140 on changed appendices.

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	Section	**Reviewer**	**Reviewer's Comment**	**Response**
			focusing on using nuclear safety culture surveys as another performance improvement tool. Given this, Bruce Power strongly encourages the CNSC to remove Appendix B from future versions of this REGDOC**.**	
163	6. Appendix B: Safety Culture Maturity Model	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Industry believes the proposed nuclear safety culture maturity model is misaligned with the nuclear safety culture characteristics and poorly integrated overall with the draft REGDOC. Its use could create an environment where a licensee's culture is perceived as an absolute value that is simply pass or fail. Licensees are deeply concerned that indicator scores would be used to plot stage 1, 2 or 3 and culture cannot be measured by a set of indicators. Industry notes that in Table B1, the indicators section does not seem to list indicators at all. The IAEA has a number of documents and programs aimed at countries that are newly developing a nuclear industry and regulatory infrastructure. 'Stage 1: Requirement-driven' of the maturity model appears to be directed towards such countries. However, Canada has an established, internationally-recognized nuclear regulatory infrastructure. Operating within that infrastructure, licensees are already committed to remain within 'Stage 3: Continually improving.' Licensees strongly recommend the CNSC remove the entirety of Appendix B and any references to the Maturity Model. **Major** This is a secondary methodology which is not aligned to the characteristics or attributes (i.e. the diversity element). This introduces another framework and would create an additional administrative burden with no apparent, corresponding value. There could potentially be unintended outcomes and consequences of using this maturity model causing strict compliance and a lowering of standards. It could pressure licensees to meet fixed culture score requirements rather than focusing on utilizing nuclear safety culture surveys as another performance improvement tool. Considering a nuclear safety culture assessment is, in part, the workforce's perception of safety, using a maturity model based on rigid scores could create an environment in which licensees shy away from any initiatives that could give workers a perception that safety needs improvement since this could result in lower scores.	The REGDOC was modified as result of comments. See comment 19 on the balance of information and requirements. See comment 140 on changed appendices.

Comments received during public consultation period September 26-November 28, 2016				
	Section	**Reviewer**	**Reviewer's Comment**	**Response**
164	6. Appendix B: Safety Culture Maturity Model	SNC- Lavalin	SNC-Lavalin Nuclear views the maturity model in Appendix B to be unnecessary in the level of detail that the CNSC is recommending. It should be sufficient to refer to the three IAEA documents listed in Appendix B. In planning nuclear safety culture assessments, each organization should have the freedom to develop its own internal indicators of maturity levels, commensurate with its licensed activities and business needs.	The REGDOC was modified as result of comments. See comment 140 on changed appendices.
165	6. Appendix B: Safety Culture Maturity Model	Cameco	Cameco believes the proposed nuclear safety culture maturity model (Appendix B) is misaligned with the nuclear safety culture characteristics and poorly integrated overall with the draft REGDOC. Its use could create an environment where a licensee's culture is perceived as an absolute value that is simply pass or fail. Cameco is deeply concerned that indicator scores would be used to plot stage 1, 2 or 3 and that the CNSC would expect some sort of traceable analytical methodology to link the safety culture assessment to the maturity model indicators, which are not part a safety culture framework. Cameco strongly recommends the CNSC remove the entirety of Appendix B and any references to the Maturity Model.	The REGDOC was modified as result of comments. See comment 19 on the balance of information and requirements. See comment 77 on mapping frameworks. See comment 140 on changed appendices.
166	6. Appendix B: Safety Culture Maturity Model	OPG	When looking at the Maturity Model, it is difficult to see how this is an empirical method of measurement. We believe it would be difficult to prove with evidence where we fall on the model, and given that every organisation has sub-cultures within its culture, it is difficult to understand how it would be applied at the organisational level. We would need to clarify what data would be expected to support each element of the model and what value this gives to improving safety culture. Driving strict compliance to this model could cause unintended consequences such as lowering our own standards while possibly letting other things go by unnoticed because they are not part of this model. Additionally, this model does not easily tie back to the framework the CNSC proposed.	The REGDOC was modified as result of comments. See comment 140 on changed appendices.
167	6. Appendix B: Safety	Bruce Power, NB Power, OPG, CNL, SNC Lavalin	Why does the CNSC want to incorporate an unfamiliar, untested maturity model requirement? What value is expected? How will it be used? Does the CNSC consider the maturity model an empirical method of measurement? Is this intended to be a secondary assessment methodology? Given industry's questions on the	The REGDOC was modified as result of comments. See comment 140 on changed appendices.

Comments received during public consultation period September 26-November 28, 2016				
	Section	**Reviewer**	**Reviewer's Comment**	**Response**
	Culture Maturity Model		maturity model, what assurances do licensees have that guidance provided in the document will be managed as guidance and not as requirements? *Requests for clarification*	
168	6. Appendix B: Safety Culture Maturity Model	Canadian Nuclear Workers Association	The CNA and its members recommend that the proposed safety culture maturity model described in Appendix B be dropped from the REGDOC. It is our view that the proposed maturity model is not aligned with key nuclear safety characteristics and does not align very well with the balance of the REGDOC. The use of this model is likely to create an environment where there is a focus on strictly pass or fail which could in turn result in licensees focusing on certain targets rather than focusing on overall improvement	The REGDOC was modified as result of comments. See comment 19 on the balance of information and requirements. See comment 140 on changed appendices.
169	6. Appendix B: Safety Culture Maturity Model	J Froats	Appendix B provides some good background information - but seems to focus on providing some guidance for Regulatory evaluation. It may also be more suited to a separate document with a clear focus.	The REGDOC was modified as result of comments. See comment 140 on changed appendices.

Table C: Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017 (Green banner)

Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017			
	Section	**Reviewer's Comment and Proposed Change**	**Response**
170	Stakeholder Perspectives	All of the stakeholders present at the workshop recognized the importance of safety culture	While comments are acknowledged, no changes to the REGDOC were suggested.

Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017			
	Section	**Reviewer's Comment and Proposed Change**	**Response**
			See comment 4 on the importance of safety culture.
171	Stakeholder Perspectives	The industry stakeholders want to ensure that any safety culture requirements and guidance are clearly applied to the right licence class and activity type, using a graded approach -Suggested embedding the scope statement within the REGDOC to clarify which requirements and guidance apply to which licensees	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements. See comment 19 on the balance of information and requirements.
172	Stakeholder Perspectives	The objectives of the document are not clear: -Are the objectives to (1) foster safety culture (2) conduct safety culture assessments or (3) improve safety or nuclear safety? -The bulk of the document is currently devoted to guiding safety culture assessments rather than improving safety culture.	The REGDOC was modified as result of comments. See comment 26 on the purpose of the REGDOC.
173	Stakeholder Perspectives	The industry stakeholders believe that the "Nuclear safety culture" definition currently used by the nuclear industry is better at communicating the specific and unique nature of the nuclear industry to their work force, including their contractors. Furthermore: -The stakeholders believe that there is a need to utilize a common language. -There is a concern that industry will be required to adopt the CNSC's definition of safety culture. -Some industry stakeholders expressed the importance of considering both nuclear safety and conventional safety.	The REGDOC was modified as result of comments. See comment 46 on safety culture definition.
174	Stakeholder Perspectives	The stakeholders desire greater flexibility in selecting their methods. More specifically, stakeholders believe that: -The methodology guidance in the REGDOC is too prescriptive. -The process of conducting safety culture assessments is a learning opportunity of great value. -Safety culture assessment results need to be presented in the language of the station to support improvement opportunities. -There was a further concern that the concept of "culture" is not well understood in the language of psychology.	The REGDOC was modified as result of comments. See comment 19 on the balance of information and requirements. See comment 43 on multiple safety culture definitions. See comment 94 on assessment thoroughness.

Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017			
	Section	**Reviewer's Comment and Proposed Change**	**Response**
		-An excessive focus on the safety culture assessment method may reduce the resources available to invest in safety improvement initiatives.	
175	Stakeholder Perspectives	The stakeholders recognize the challenging nature of applying the REGDOC to a wide range of licensees.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 1 on applicability of requirements. See comment 19 on the balance of information and requirements.
176	Stakeholder Perspectives	Stakeholders believe that a foundational pillar supporting safety culture is ensuring that all workers are comfortable raising issues without fear of repercussions.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 23 on fear of reprisal.
177	Stakeholder Perspectives	There were concerns raised about the maturity model in Appendix B: -The industry stakeholders want clarification (i.e. is it mandatory?) and expressed a preference for its removal. -Union stakeholders, on the other hand, find value in the maturity model.	The REGDOC was modified as result of comments. See comment 140 on changed appendices.
178	Stakeholder Perspectives	Concerns about "scoring" safety culture: -Safety culture is recognized as a point-in-time measure which may be influenced by variety of things affecting the organization. -Stakeholders are concerned that the maturity model may be used for scoring the licensees.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 140 on changed appendices. The CNSC does not intend to introduce a scoring system for safety culture or to do cross comparisons among licensees and encourages its use as a self-reflective tool.
179	Stakeholder Perspectives	Stakeholders recognized the need to guarantee confidentiality for workers who participate in safety culture assessments as an essential stipulation for ensuring ongoing openness.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 145 on participant confidentiality.

Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017			
	Section	**Reviewer's Comment and Proposed Change**	**Response**
180	Stakeholder Perspectives	A safety culture assessment is an administrative document exercise.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 24 on continual monitoring.
181	Stakeholder Perspectives	Some stakeholders regard combining security and safety culture together to be a pre-mature action.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 51 on the inclusion of security culture.
182	Stakeholder Perspectives	The oversight role of the CNSC varies for different types of licensees.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 1 on applicability of requirements.
183	Stakeholder Perspectives	Several industry stakeholders expressed concerns about the use of "safety culture" versus "nuclear safety culture:" -The terminology may have the unintended consequences of reducing clarity and shifting the focus from nuclear safety to conventional safety. -Some consider the terminology difference to constitute a missed opportunity. -The "nuclear" modifier shifts people's focus to nuclear safety risks. -Without the word "nuclear," the default interpretation may be conventional safety. -The term needs the nuclear word/sentence/descriptor so that people do not mistakenly default solely to conventional health and safety. -It would require significant "rebranding" for NPPs to change their current terminology from "nuclear safety culture" to simply "safety culture." -For smaller licensees, the word nuclear relates to a smaller aspect of what they do. -The challenges of the one-size-fits-all approach were recognized.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 46 on safety culture definition.
184	Stakeholder Perspectives	Some stakeholders opined that conventional safety cannot be separated out/eliminated when discussing safety culture and therefore preferred the CNSC term "safety culture" over the term "nuclear safety culture."	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 46 on safety culture definition.

Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017			
	Section	**Reviewer's Comment and Proposed Change**	**Response**
185	Stakeholder Perspectives	The was a desire for a common definition for "safety culture:" -It is challenging to create a common understanding internationally if everyone is using a different definition. -Industry stakeholders desire the CNSC to adopt the definition that will be adopted by the IAEA/WANO/INPO. -If there is a need for the CNSC to use a different definition, the CNSC must explain their choice with a clear rationale (e.g., applying a higher standard). -If the CNSC does demand more than the baseline requirement, then that is also to be clearly explained and why.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 43 on multiple safety culture definitions. See comment 46 on safety culture definition.
186	Stakeholder Perspectives	The CNSC definition does not currently include the emphasis of "*safety over competing goals*" which is included in the IAEA definition. This may become problematic.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 46 on safety culture definition.
187	Stakeholder Perspectives	The NPPs recognize that the focus on security culture is coming from the international community.	While comments are acknowledged, no changes to the REGDOC were suggested.
188	Stakeholder Perspectives	There was agreement that security and safety culture can be addressed in one REGDOC, but the two cannot necessarily be addressed in the same way.	The REGDOC was modified as result of comments. See comment 51 on the inclusion of security culture. Section 3.2 states:"…licensees may choose to undertake independent assessments to assess security culture."
189	Stakeholder Perspectives	There was a request to focus on security culture for high security sites exclusively rather than for all licensees: -Allow high security sites to develop methods, which they can then share with smaller licensees	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 1 on applicability of requirements. See comment 51 on the inclusion of security culture.
190	Stakeholder	A note was made of the inherent contradiction in the security culture definition mentioning "nuclear" and	While comments are acknowledged, no changes to the

Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017			
	Section	**Reviewer's Comment and Proposed Change**	**Response**
	Perspectives	"behaviour" while the safety culture definition does not -Stakeholders requested that both concepts be treated consistently	REGDOC were suggested. See comment 46 on safety culture definition. See comment 51 on the inclusion of security culture. The definition of security culture has been modified to align with the safety culture definition.
191	Stakeholder Perspectives	A participant noted that the World Institute for Nuclear Security (WINS) security culture sample survey questions are more questions of fact versus opinions/perceptions and are likely not suitable to gauge culture.	While comments are acknowledged, no changes to the REGDOC were suggested.
192	Stakeholder Perspectives	Stakeholders requested clarity on whether the document is addressing the security organization or the organization as a whole.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 94 on assessment thoroughness.
193	Stakeholder Perspectives	The method is too prescriptive: -Ensure that the REGDOC provides sufficient flexibility so that licensee methods may evolve over time to address the lessons learned from both their experience and international experience. -It will be too complex to assess security culture. -There is a potential for unintended consequences.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 94 on assessment thoroughness. See comment 57 on methodology.
194	Stakeholder Perspectives	There was a desire for the scope of the REGDOC to be clearer, so that the licensees will know how they will be assessed.	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements. See comment 19 on the balance of information and requirements.
195	Stakeholder Perspectives	Please identify which requirements and guidance apply to whom within the text of the document rather than in attached Appendix A.	The REGDOC was modified as result of comments.

Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017			
	Section	**Reviewer's Comment and Proposed Change**	**Response**
			Table A1 has been rescinded.
196	Stakeholder Perspectives	Some non-NPP stakeholders perceive the included maturity model to be useful guidance.	The REGDOC was modified as result of comments. See comment 19 on the balance of information and requirements. See comment 140 on changed appendices.
197	Stakeholder Perspectives	Some stakeholders expressed a preference for the maturity model not to be prescriptive -Suggested a removal of the maturity model from the REGDOC and instead suggest a referencing of a variety of maturity models	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 140 on changed appendices.
198	Stakeholder Perspectives	Some stakeholders see that there is value in the maturity model indicators: -Stakeholders highlighted the importance of some elements that were included in the maturity model indicators and specific behaviours (e.g., safety prioritized over production goals and not finding someone to blame for incidents). -Some recognized the different levels of maturity between the employees and contractors/building trades.	See comment 140 on changes appendices.
199	Stakeholder Perspectives	The intent of the descriptive text in the maturity model is unclear.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 140 on changed appendices.
200	Stakeholder Perspectives	The licensees want to ensure that they would not be scored by CNSC staff and have their results compared against one another (e.g., via the NPP report) -Greater clarity is needed about whether the maturity model is a tool to promote the self-reflections of licensees or if it is an evaluative tool for CNSC staff to assess a licensee's safety culture	The REGDOC was modified as result of comments. See comment 140 on changes appendices. See comment 178 on evaluation of safety culture assessments.

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	Section	**Reviewer's Comment and Proposed Change**	**Response**
201	Stakeholder Perspectives	The origin of the maturity model indicators is unclear. The relationship between safety culture attributes and the maturity model is unclear as well.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 140 on changed appendices.
202	Stakeholder Perspectives	Stakeholders expressed the importance of aligning CSA N286-12 and REGDOC-2.1.2 , as well as avoiding duplication between the two documents -Licensees meet the requirements for monitoring in CSA N286-12 through periodic assessments, not through ongoing monitoring -CSA N286-12 may apply to some licensees, does not necessarily mean some sections of the REGDOC will apply to these licensees as well	The REGDOC was modified as result of comments. See comment 56 on elaboration on N286-12.
203	Stakeholder Perspectives	There was an expressed concern that moving monitoring to section 2 (*fostering safety culture*) would create added burdens -A range of licensees raised concerns about guidance for the ongoing monitoring of safety culture being moved to section 2 -NPP licensees already have measures for the ongoing monitoring of safety culture -There was concern about some of these monitoring activities being captured as regulatory guidance	The REGDOC was modified as result of comments. See comment 56 on elaboration on N286-12.
204	Stakeholder Perspectives	Stakeholders are concerned that the focus on safety culture monitoring could encourage a shift in focus to "*culture outcomes*" from "*safety outcomes.*"	The REGDOC was modified as result of comments. See comment 24 on continual monitoring.
205	Stakeholder Perspectives	Stakeholders desire clarity about the requirements and guidance related to the safety culture framework -Clarity is needed about what happens if there are gaps between a licensee's and the CNSC's safety culture frameworks	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.
206	Stakeholder Perspectives	The proposed wording in Slide 51 is confusing: -There was a suggestion for wording to provide mapping to facilitate CNSC's review. -Would mapping be a requirement or guidance?	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.
207	Stakeholder Perspectives	Some of the security elements included in the safety culture framework in the draft REGDOC are more fact-based than worker perception-based.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 51 on the inclusion of security culture.

Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017			
	Section	**Reviewer's Comment and Proposed Change**	**Response**
208	Stakeholder Perspectives	(Topic 3: mapping) When a duality added to attribute (i.e., safety and security), it is two questions, not one -The current question set is validated for assessing safety culture -Would need to validate questions to assess security culture -Response could be different if worker is considering safety or security	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 77 on mapping frameworks. See comment 94 on assessment thoroughness.
209	Stakeholder Perspectives	There was agreement that safety culture assessments should be rigorous.	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.
210	Stakeholder Perspectives	There was a perception among stakeholders that the focus of the safety culture assessments is academic instead of supporting learning and improvement.	While comments are acknowledged, no changes to the REGDOC were suggested.
211	Stakeholder Perspectives	Licensees believe safety culture improvement outcomes to be more important than the rigour of methodologies.	While comments are acknowledged, no changes to the REGDOC were suggested.
212	Stakeholder Perspectives	Smaller licensees are concerned about the implications of using some methodologies.	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements. See comment 19 on the balance of information and requirements.
213	Stakeholder Perspectives	There were concerns about: -the documentation required to demonstrate that the bullets in Section 3.1 are addressed -the licensee having to defend the rigour of the safety culture assessment -how guidance may be applied by CNSC staff -the sufficiency of existing methods with respect to the guidance in the REGDOC -the lack of recognition of the learning of the assessment team and the involvement of leaders in -identifying appropriate improvement actions	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.
214	Stakeholder Perspectives	It is unclear if the draft REGDOC will result in licensees having to drastically change their current approach to safety culture assessments.	The REGDOC was modified as result of comments.

Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017			
	Section	**Reviewer's Comment and Proposed Change**	**Response**
			See comment 94 on assessment thoroughness.
215	Stakeholder Perspectives	It is unclear if it is the licensee's responsibility to demonstrate to the Commission that their assessment approach is fit-for-purpose [self-determined], or rather if it is the CNSC's responsibility to assess the licensee's assessment approach and determine if it is fit-for-purpose.	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.
216	Stakeholder Perspectives	The methodology must find the right balance between science and safe plant operations.	While comments are acknowledged, no changes to the REGDOC were suggested.
Reflections on Day 1 of the workshop			
217	Stakeholder Perspectives	Keep focus on engagement and learning	While comments are acknowledged, no changes to the REGDOC were suggested.
218	Stakeholder Perspectives	All present at stakeholder meeting are passionate about safety culture and recognize its importance -Recognition that stakeholders and CNSC have mutual goals related to safety culture -Everyone wants to do a good job in this area	While comments are acknowledged, no changes to the REGDOC were suggested.
219	Stakeholder Perspectives	The workshop and the "What we heard" slides were an accurate reflection of what was said during the meeting, but it is not clear how the REGDOC will be modified as a result -There are still gaps between the COG presentation and the CNSC's position -Would like feedback about how CNSC staff will act upon "What we heard"	While comments are acknowledged, no changes to the REGDOC were suggested. This disposition table details how the comments raised during the workshop resulted in changes to the document.
220	Stakeholder Perspectives	Workshop meeting has been a good opportunity for discussion and learning from each other.	While comments are acknowledged, no changes to the REGDOC were suggested.
221	Stakeholder Perspectives	For security culture, licensees need a graded approach and room for development.	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements.
222	Stakeholder Perspectives	Clarity is essential as: -Words matter -The CNSC staff need to ensure that what is asked for in the REGDOC is exactly what is needed and that the wording will get the result that is intended	While comments are acknowledged, no changes to the REGDOC were suggested.

Comments received during Stakeholder Safety Culture Workshop June 27-28, 2017			
	Section	**Reviewer's Comment and Proposed Change**	**Response**
223	Stakeholder Perspectives	There is concern that the REGDOC may lead to a check-box-approach to verifying compliance, by CNSC staff.	Comment noted. Compliance verification activities will be determined by CNSC staff during the implementation of the REGDOC, following its anticipated publication. See comment 178 on evaluation of safety culture assessments.
224	Stakeholder Perspectives	It is essential that workers are: -comfortable raising questions without fear of reprisal -not distracted from safety by cost/production (e.g., project must stay on budget)	The REGDOC was modified as result of comments. See comment 23 on fear of reprisal.
225	Stakeholder Perspectives	There was concern that differentiating between "safety culture" and "nuclear safety culture" may lead to people questioning if they are in "nuclear space."	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 46 on safety culture definition.
226	Stakeholder Perspectives	Safety culture work is tightly linked with human performance.	While comments are acknowledged, no changes to the REGDOC were suggested.
227	Stakeholder Perspectives	Safety culture assessments are tools for improvement that support licensees, so that they may run their plants safely.	While comments are acknowledged, no changes to the REGDOC were suggested.
228	Stakeholder Perspectives	There is concern that current safety culture assessment practices may require significant changes to comply with the REGDOC -Current practices are perceived to be fit-for-purpose -Could cause a "big step back" if industry has to drastically change its current practice -The REGDOC needs to allow for a pragmatic, practical approach -The REGDOC is perceived to increase the requirements on industry rather than codify current practice.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 94 on assessment thoroughness.
229	Stakeholder Perspectives	There are concerns about the requirements and guidance related to method -This is the area where there is not a consensus -Stakeholders do not want academic approach to method to draw away from the good things already	The REGDOC was modified as result of comments. See comment on 57 on methodology.

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		being done -Licensees are concerned that they will have to devote resources to demonstrate the scientific validity of their methods -There is a preference for focusing on safety rather than getting "bogged down" on method	See comment 94 on assessment thoroughness.
230	Stakeholder Perspectives	Challenge of one REGDOC applying to all licensees is recognized by stakeholders -Objection to differentiating licensees using the term "small" -REGDOC needs to be something all licensees can implement / live with -Graded approach is needed (e.g., 4000-person NPP vs. 2-personoperation) -One way to differentiate between licensees is by determining whether they are CSA N286-12 compliant or not	The REGDOC was modified as result of comments. See comment 1 on applicability of requirements.
231	Stakeholder Perspectives	There is concern about the impact of the regulation in general and the cumulative burden of a suite of regulatory requirements -Industry is going to "push back" on regulatory requirements (from CNSC and other regulators), especially if it is not clear what we are trying to fix and that the benefits for nuclear safety justify the costs -Industry has limited resources – therefore resources devoted to safety culture assessments are not available for other safety initiatives	While comments are acknowledged, no changes to the REGDOC were suggested.
232	Stakeholder Perspectives	Recommendation for REGDOC to include guiding principles related to composition of team members and lead.	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 131 on team selection.
233	Stakeholder Perspectives	Consider if first two paragraphs of Section 3.3.3 could be sufficient.	The REGDOC was modified as result of comments. See comment 131 on team selection.
234	Stakeholder Perspectives	Some stakeholders requested a union appointment to the safety culture assessment team while others objected to a union appointment -A union appointment to the safety culture assessment team would assist with buy-in of results and greater transparency with workers/union members -Union appointment has been successful in other Health and Safety work (e.g., Health and Safety	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 131 on team selection.

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	Section	**Reviewer's Comment and Proposed Change**	**Response**
		Committee, event investigation teams) -Statement made that union appointment could be included in licensee governance versus in regulatory requirements or guidance	
235	Stakeholder Perspectives	The use of SRS-83 was discussed -Preference as reference / additional information material rather than as guidance -SRS-83 has not been thoroughly reviewed by stakeholders	While comments are acknowledged, no changes to the REGDOC were suggested.
236	Stakeholder Perspectives	Concern raised about references to CSA N286-12 when this is already a requirement for many licensees. Specifically there were concerns: -that the record-keeping section (section 3.5) adds no value to the REGDOC since it already has to be done -that the record-keeping section (section 3.5) is too prescriptive -that there is a potential conflict between the objectives of learning, engagement and improvement versus the objectives of regulatory review and reporting -about the CNSC's expectation of what is to be documented in the licensees' summary of results	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 56 on elaboration on N286-12. See comment 141 on suggested documents and records for safety culture assessments.
237	Stakeholder Perspectives	Stakeholders were concerned about the application of the guidance in the REGDOC by CNSC staff.	While comments are acknowledged, no changes to the REGDOC were suggested.
238	Stakeholder Perspectives	If guidance is "for information," this should be clearly stated.	The REGDOC was modified as result of comments. See comment 27 on the guidance language. See comment 19 on the balance of information and requirements.
239	Stakeholder Perspectives	Concern that participation in this workshop is a sign that stakeholders are in agreement with contents of REGDOC0 -Still considerable differences and concerns related to requirement and guidance for "empirical, valid, practical and functional" assessments -Still concerns regarding how licensees would demonstrate fulfillment of those four words -Recommended that the four words would be removed	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 94 on assessment thoroughness. See comment 17 on compliance.

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	Section	**Reviewer's Comment and Proposed Change**	**Response**
240	Stakeholder Perspectives	Licensees believe they are getting effective results with their current assessment methodologies.	While comments are acknowledged, no changes to the REGDOC were suggested.
241	Stakeholder Perspectives	Slide 87 – There was a suggestion to merge requirement 2 and 3 to "Conduct safety culture assessments at least every 5 years" -Proposal to qualify with: -"systematic" safety culture assessment and/or -using good industry practice -Need to find balance between "science experiment" and "fluffy" -Recognition that level of a certain level of rigour is required	The REGDOC was modified as result of comments. See comment 94 on assessment thoroughness.
242	Stakeholder Perspectives	Potential change to section 2: -Establish/use a framework -Potential third requirement Potential change to section 3: -Periodic assessment against the framework (established in section 2) that describes characteristics of a healthy safety culture	The REGDOC was modified as result of comments. See comment 77 on mapping frameworks.
243	Stakeholder Perspectives	The stakeholders are less concerned about the re-ordering of draft REGDOC 2.1.2, as their main concerns are about content and not the structure of the document.	While comments are acknowledged, no changes to the REGDOC were suggested.
244	Stakeholder Perspectives	Question on what 2.1 safety culture policy would involve -What is the issue being fixed?	The REGDOC was modified as result of comments. The REGDOC now refers to governing documentation.
245	Stakeholder Perspectives	Concern with the title of "Safety Culture Policy" -Need to change title so as not to inadvertently prescribe a policy	The REGDOC was modified as result of comments. The idea of Safety culture policy was brought up at the workshop. The REGDOC wording now refers to governing documentation.

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	Section	**Reviewer's Comment and Proposed Change**	**Response**
246		NEXT STEPS SLIDE: -Revise REGDOC 2.1.2, *Safety Culture* and formalise Disposition Table	While comments are acknowledged, no changes to the REGDOC were suggested.
247	John Froats' email	The subject of adverse executive influence does not seem to be addressed.	The REGDOC was modified as a result of comments provided. The importance of leadership was included in the revised introduction of the REGDOC. GSR Part 2, Leadership and Management for Safety, addresses leadership and its importance to safety culture. The guidance for GSR Part 2 has yet to come. Further revisions of the REGDOC will incorporate this guidance on leadership, including executive leadership, for safety culture. Additionally, following the list in section 2.2 Ongoing monitoring of safety culture, a sentence reads, "Additional information on ongoing monitoring of safety culture may be found in NEI 09-07 Revision1, Fostering a Healthy Nuclear Safety Culture [17]." This document is used by Canadian NPPs, and has guidance for fleet nuclear safety culture executive teams to engage in an "in-depth collegial discussion" based on safety culture relevant data that is given to them through safety culture monitoring panels and site leadership teams, and other sources of information. "This group is charged with looking at corporate-level or fleet-wide safety culture, as determined by corporate leadership. This includes looking at the role of corporate decision- making in shaping site safety culture and looking for issues and trends in

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	Section	**Reviewer's Comment and Proposed Change**	**Response**
			corporate or fleet safety culture" (pg 13). The goal is to understand concerns that "require engagement of corporate leadership to resolve".
248	John Froats' email	Competency aspects seem to be missing.	See comment 131 on team selection. See comment 91 concerning leadership understanding culture See comment 247 on leadership.
249	John Froats' email	Seems to still be a large focus on surveying which while useful input is not really the centerpiece of safety culture.	See comment 94 on assessment thoroughness. See comment 121 on the diversity of data used in fostering and assessing safety culture.
250	John Froats' email	There was strong consistent feedback that we should not try to address both Security Culture and Safety Culture at this time but it appears you intend to head in that direction in spite of the feedback. I am well familiar with the IAEA's desire to have them integrated but I am of the view along with other stakeholders, that we would be better served to get Safety Culture framed first and follow later with the integration of the Security concepts – maybe even start with two documents and merge later. I have no issue with the IAEA view – it is simply a matter of the best approach to change management	While comments are acknowledged, no changes to the REGDOC were suggested. See comment 51 on the inclusion of security culture.
251	John Froats' email dated Nov 30 2017	I remain of the view that the document going forward is too focused on the survey process, misses several of the points put forward in earlier input, some of which were based on precursor contributors that were actually contributing factors in previous major events (within the nuclear sector and in the broader nuclear context). As a result I believe is unlikely to be fully effective in contributing to the avoidance of future events.	See comment 25 on the purpose and intent of this REGDOC See comment 94 on assessment thoroughness. See comment 121 on the diversity of data used in fostering and assessing safety culture.
252	John Froats' email dated Dec 11 2017	The document seems to focus predominantly on safety culture surveying rather than the broader programmatic issues that influence culture in an organization.	See comment 25 on the purpose and intent of this REGDOC See comment 94 on assessment thoroughness.

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	Section	**Reviewer's Comment and Proposed Change**	**Response**
			See comment 121 on the diversity of data used in fostering and assessing safety culture.
253	John Froats' email dated Dec 11 2017	Competency in leadership, in my experience is a function of knowledge, experience and attitude. Lots of major events have been a result of executive influence that is not aligned with the kind of decision making needed to avoid taking the kinds of risks that when in place long enough set the stage for major events. Titanic for example resulted from influence from the White Star Board and Executive – resulting in a schedule over conservative and prudent behavior throughout the company. It is thematic. The document seems silent (in my view) on any tangible measures that would enable detection and correction of these kinds of things before risk taking behavior emerges or a major event brings focus. I noticed the document was revised to mention the influence of incentive programming – but it is not prominent.	See comment 24 on continual monitoring. See comment 247 on leadership.

Table D: Comments received from industry on January 9, 2018 (after final draft has been sent to stakeholders) – purple banner

Comments received from industry on January 9, 2018 (after final draft has been sent to stakeholders)			
	Section	Reviewer's comment and Proposed Change	Response
254	Preface	**Issue:** Under the Preface, this draft says, "Guidance contained in this document exists to inform the applicant, to elaborate further on requirements or to provide direction to licensees and applicants on how to meet requirements. It also provides more information about how CNSC staff evaluate specific problems or data when they review licence applications. Licensees are expected to review and consider guidance; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements." **Suggested change:** Revise wording to: "Licensees are expected to review and consider guidance~~; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements.~~" To define guidance 'to inform applicant to elaborate further on requirements and to provide additional	While comments are acknowledged, no changes were made to the text of the document. See comment 30 on preface language.

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		information to licensees and applicants on how to meet requirements' does not sound like guidance but further direction on requirements. **Impact on industry:** This adds confusion to what can be considered guidance versus requirements in the document and adds unnecessary regulatory burden. Licensees note that a similar statement appears in all REGDOCs, which puts an unreasonable onus on licensees to demonstrate not only how requirements are met, but also how guidance is met. Guidance is meant to be guidance. If a licensee is required to meet guidance criteria (even by other means), then it is a requirement, not guidance. The effort to 'explain how their chosen approach meets regulatory requirements' takes effort away from other activities aimed at implementing requirements and improving safety. The additional administrative burden is not commensurate with safety improvement.	
255	1.	**Issue:** Under 1. Introduction The REGDOC defines safety culture as the characteristics of the work environment, such as the values, rules, and common understandings that influence workers' perceptions and attitudes about the importance that the organization places on safety. This definition is aligned with others being used in the nuclear industry, sharing common elements and overall goals. The CNSC has chosen to create a new one that does not significantly improve on existing ones. **Suggested change:** Licensees suggest the CNSC adopt an existing, accepted international standard definition such as the IAEA or WANO/INPO definition of nuclear safety culture, which says: "*Nuclear Safety Culture is defined as the core values and behaviours resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment.*" **Impact on industry:** Adopting an existing, internationally-recognized definition would help foster a common international understanding of nuclear safety culture. The use of common definition that is accepted internationally would help promote further collaboration and understanding and reduce the need for revising existing documentation and training.	While comments are acknowledged, no changes were made to the text of the document. See comment 43 on multiple safety culture definitions. The CNSC has had a consistent definition for decades and we will monitor closely the international development led by the IAEA. See Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2 Safety Culture section 1.3 for more discussion on safety culture definitions in the nuclear industry.
256	1.4.1	**Issue:** The maturity of safety culture assessment methodology significantly exceeds that of security culture	While comments are acknowledged, no changes were made to the text of the document.

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		methodology. Therefore, additional time to implement security culture assessments will be required. **Suggested change:** Remove the explicit reference to security culture as part of safety culture at this time or include a statement recognizing Industry requires sufficient time to collaborate and develop methodologies. **Impact on industry:** Including security assessments too soon runs the risk of detracting from the quality of existing safety culture assessments and improvement efforts. It will result in an increase in effort, costs and resources and industry requests the time to collaborate.	See comment 51 on the inclusion of security culture. See Rational for security culture inclusion in REGDOC 2.1.2 Safety Culture. The document outlines Canada's and the international position on safety and security, an analysis of the integration on safety and security, and some practices related to safety and security integration.
257	3 and 3.1	**Issue:** Using the descriptors "comprehensive, systematic and rigorous" in the requirements part of section 3 continues to generate confusion. Industry recognizes these terms are used in Guidance to give licensees suggestions for a set of criteria to ensure assessments are consistent and reliable over time. However, listing them first in the section 3 requirement statement and then defining them in Guidance makes them defacto requirements. Given this, it is unclear how the bullet points under the terms "comprehensive, systematic and rigorous" are going to be applied. **Suggested change:** To avoid confusion and maintain the guidance necessary to ensure the rigour of assessments, industry suggests: • Amending section 3 slightly to say, "Licensees shall conduct safety culture assessments at least every five years." • Amending section 3.1 to clarify the bullet points are general guidance and licensees will not be required to "prove" they meet each of the specific bullet points. Industry suggests rewording to say, "The following is a set of characteristics that improve the quality of safety culture assessments and may be used to develop, improve and refine safety culture assessments." In addition, industry suggests making the following changes in section 3.1: Comprehensive	The second requirement of the REGDOC has not been modified and still reads: "Licensees shall conduct comprehensive, systematic, rigorous safety culture assessments at least every five years." See comment 94 on assessment thoroughness. For Section 3.1: Comprehensive: While comments are acknowledged, no changes were made to the text of the document. Systematic: The REGDOC was modified as result of comments. The word 'recorded' has been changed to "documented". Rigorous: The REGDOC was modified as result of comments. • The words 'control for' with 'minimize the chance for' were replaced. • The 2nd bullet was changed to read "The methods are defensible and are described in sufficient detail so that they can be replicated by different individuals and across time."

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		• Add the word 'nuclear' before organization. It is too broad to indicate assessments must assess the entire organization since many licensees have non-nuclear parts of their businesses that would not be part of an assessment. Systematic • Replace the word 'recorded' with 'shown' in the 3rd bullet and remove the phrase, 'to allow traceability throughout the analysis.' As with the 2nd bullet, this implies it can later be reviewed and seems to point to an expectation of very explicit traceability and direct links to raw data collected during an assessment. In fact, this information is used to draw conclusions in the assessment and then discarded for confidentiality purposes. • Replace the 5th bullet with, 'actions resulting from the assessment are linked to the conclusions of the assessment and input from people interviewed and survey comments. Rigorous • Replace the words 'control for' with 'minimize the chance for' • Remove the 2nd bullet, which is part of guidance but implies there will be a 'requirement' for licensees to carry out activities to 'defend' and 'describe in sufficient detail' so that different individuals could replicate the analysis across time. This would add a significant administrative burden. If it is felt some guidance is needed on this point, shorten the 2nd bullet to simply say, "The methods and subsequent analyses are defensible and described in detail." It is unrealistic to expect different individuals not participating in the assessment to necessarily come to the same conclusions. **Impact on industry:** This section has the potential to add significant burden to the safety culture assessment process by focusing efforts on proving the acceptability of the process. While the list of 'criteria' defining comprehensive, systematic and rigorous are helpful to inform what is meant by the terms, as currently written, section 3.1 is a requirement and not guidance. In their current form, some of the bullets clearly indicate a potential significant administrative burden to 'defend, replicate across time by different individuals.' This additional effort would pose a significant burden without a commensurate benefit in safety and could negatively impact an organization's commitment to undertake safety culture assessments and the degree of documentation required.	See Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2 Safety Culture sections 6 (which addresses assessing safety culture in general terms) and 7 (which looks at assessments in more detail).
258	3.0 and 3.1	**Issue:** Principle 3 page 8 includes Guidance that 'assessments 'should' be carried out as operational needs dictate and lists a number of examples.	While comments are acknowledged, no changes were made to the text of the document.

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		3.5 Data analysis pg 12 **Suggested change:** Change the word 'should' to 'may' as this leaves the requirement flexible on frequency and interpretation related to operational needs (e.g., governance, structure, responsibilities). This guidance should not be prescribed as 'should.' Remove 2nd para, 3rd sentence. **Impact on industry:** In addition, the choice of words in section 3.5 Data analysis pg 12 'The assessment team should periodically review assessment objectives (such as those listed in section 3.1 of this document) to ensure adherence to methodological criteria' also infers these criteria are requirements and not guidance.	See comment 30 on preface language.
259	3.3.1	**Issue:** Under 3.3.1 states Team members should collectively have knowledge and experience in: •human factors and behavioural/social sciences •qualitative and quantitative methods for cultural assessment assessments of safety culture •various functional area specialties (e.g. security, workers both unionized and not unionized as applicable, operations, maintenance, corporate office staff, senior management) •technologies of the organization **Suggested change:** Change should to may – Team members ~~should~~ may collectively have knowledge and experience in…. Remove 'corporate office staff' as this is not normally done for some licensees Remove the last sentence – as procedures on assessment methodology may include recommendations for team selection but would not expect any final documents to record 'rationale of decisions regarding team membership', these decisions are made and can be gleaned from interviews with personnel responsible for assessments but it is administrative burden to document rationale.	While comments are acknowledged, no changes were made to the text of the document. See comment 30 on preface language. See Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2 Safety Culture sections and 7 (which looks at assessments in more detail). Specifically, it looks at the SRS 83 text regarding the scope of the assessment (Step 1) and the assessment team (Step 2).

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		Impact on industry: Industry needs flexibility to choose team members to conduct effective safety culture assessments.	
260	3.3.2	**Issue:** 3.3.2 Internal communications strategy, states "For security culture, the communications plan must consider that some information is security sensitive; however, for the benefit of greater awareness, all aspects can be shared broadly even if this requires some incidents or lessons learned to be generalized." "Information should be shared with the following internal stakeholders…" **Suggested change:** Licensees urge the CNSC to remove the statement from future drafts or, at a minimum, add the words "to the extent possible" to the statement. Change the word 'should' to 'may and remove health and safety committees, union representatives, contractors, etc. Who the organisation communicates with should be left to the organisation to decide and not inferred in REGDOC. For example health and safety committees are regulated forums that deal with conventional health and safety and hence nuclear safety culture is not part of their mandate. This would go to Nuclear Safety Culture Monitoring Panels and Nuclear Safety Committees. **Impact on industry:** Sharing security information even in a broad sense would not only expose vulnerabilities. Organisations should decide what information they share with their contractors and union representatives and this should not be included in REGDOCs.	The REGDOC was modified as a result of comments provided. Change made to section 3.3.2. The sentence now reads "The information should be shared with the following internal stakeholders **to the extent possible**:" See Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2 Safety Culture sections and 7 (which looks at assessments in more detail). Specifically, it refers to the SRS 83 text regarding preparing communications (step 7), communicating results and potential impacts to management (Step 8) and communicating to the organization more broadly (Step 9).
261	3.3.3	**Issue:** The revised REGDOC states in section 3.3.3. "Licensees should ensure that the safety culture assessment framework is mapped against the five safety culture characteristics". **Suggested change:** CNSC should consider referencing the IAEA safety culture framework rather than listing the IAEA safety culture characteristics specifically. The IAEA have explicitly stated that they plan to remove these 5 safety culture characteristics from their governance and replace with the Harmonised Traits of a Healthy Safety Culture. This will ensure that the REGDOC is consistent with the IAEA Harmonised Traits of a	While comments are acknowledged, no changes were made to the text of the document. The work on the harmonized safety culture framework at the IAEA is not complete. It would be premature for the CNSC to make any changes due to the harmonization project at this juncture. See Synopsis from Science & Benchmarking Supporting

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		Healthy Safety Culture. **Impact on industry:** Adding this sentence will put the REGDOC out of alignment with IAEA and will require additional effort by licensees that is not warranted. We will continue to map our safety culture framework against the Harmonised Traits of a Healthy Safety Culture. The CNSC framework still doesn't address some traits/attributes that we currently follow that we believe are significant for a nuclear safety culture, for example, Nuclear is Recognized as Special & Unique, Challenge the unknown, Procedure Adherence, Design Margins are carefully guarded, High level of trust, Accountability for decisions, Effective Safety Communication (CO 1 and CO 4)	REGDOC-2.1.2 Safety Culture section 8 for a discussion on safety culture frameworks.
262	Section 3.7	**Issue:** The 2nd paragraph in Guidance is too prescriptive. **Suggested change:** Remove paragraph, particularly the words 'road map', 'should'. **Impact on industry:** This paragraph is too prescriptive and guidance in paragraph 1, 3 and IAEA section 7.3 is sufficient.	While comments are acknowledged, no changes were made to the text of the document. See comment 30 on preface language.
263	Several sections in Guidance	**Issue:** Throughout the Guidance sections there are statements regarding 'Documents' and 'Records'. **Suggested change:** Ensure all these sections are written as clear Guidance and include the words 'can' and not 'should' or 'may'. **Impact on industry:** Although the requirement for documented report has been removed, the guidance section still refers in many locations to the need for documents and records, inferring these are requirements and will be requested by the CNSC to review. These sections need to be clarified as to the intent of documentation that the CNSC will want to review. This administrative burden is of concern.	While comments are acknowledged, no changes were made to the text of the document. The suggested (guidance) documents and records help demonstrate what has been done during various safety culture assessment stages. See Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2 Safety Culture sections and 7 (which looks at assessments in more detail). Specifically, it refers to the SRS 83 text regarding records maintenance in conducting the self-assessment (step 5).
264	Appendix A	**Issue:** Licensees should have the ability to adjust the framework to reflect the licensee focus It should be clear that this is an example of safety culture framework, not the one licensees must use.	While comments are acknowledged, no changes were made to the text of the document.

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		Suggested change: Add the phrase "Licensees may develop their own safety culture frameworks". **Impact on industry:** Having some flexibility encourages licensees to explore aspects of culture that may be influenced by their unique circumstances and allows the licensee to explore aspects of security culture. In addition the discussed framework does not fit well with smaller licensees.	See comment 30 on preface language. See comment 77 on mapping frameworks. See Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2 Safety Culture section 8 for a discussion on safety culture frameworks.
265	Appendix A	**Issue:** Appendix A: Safety Culture Reference Framework As guidance for all licensees, the proposed safety culture reference framework is overly rigid and prescriptive. As currently written, this draft: 1)Utilizes characteristics which are not aligned to the 10 WANO/INPO Traits of a Healthy Nuclear Safety Culture currently used by many licensees. For instance, it refers to "questioning attitude," which in the traits includes "recognizing nuclear as special and unique." However, there is no characteristic in this REGDOC that supports this recognition. 2)Section 3.3.3. states, "Licensees should ensure that the safety culture assessment framework is mapped against the five safety culture characteristics" **Suggested change:** In subsequent drafts of this REGDOC, licensee's encourage the CNSC to: 1)Remove the five characteristics of safety culture from the framework as the IAEA have explicitly indicated they are removing these 5 characteristics as part of their output from the Harmonised Safety Culture framework 2)Align the framework with the familiar, industry-accepted WANO/INPO traits (or harmonised IAEA framework) and make it very clear this is simply an example framework that could be used to help licensees develop their own framework. This is already supported somewhat in the text by the phrase that calls the framework a "reference … for demonstrating a commitment to safety…" 3)State that licensee should have a detailed framework, but not require them to cover all the detailed points listed by the CNSC. **Impact on industry:** Misalignment with the WANO/INPO traits and Harmonised IAEA safety culture framework will create an additional, non-value added burden to licensees rather than build on industry's current strengths in	While comments are acknowledged, no changes were made to the text of the document. See comment 77 on mapping frameworks. Licensees are free to use any framework they feel suite their needs, including those that they feel go above and beyond, so as long as it addresses the CNSC framework. The CNSC framework has been used for decades, and is based on the equally longstanding IAEA framework. See Synopsis from Science & Benchmarking Supporting REGDOC-2.1.2 Safety Culture section 8 for a discussion on safety culture frameworks.

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		nuclear safety culture assessment. In addition, compelling licensees to use and/or address detailed safety culture characteristics that are currently listed in the CNSC framework but of limited applicability to their particular situation would only weaken the long-term viability of assessments. In Appendix A, the CNSC indicate their framework is 'adapted from' IAEA documents that are currently being revised and do not provide the rationale or basis for the adaptations made. For some licensees, the mapping of the CNSC framework to the 10 Traits shows some attributes missing from the CNSC framework which we believe are significant ensuring a healthy nuclear safety culture. The 5 IAEA characteristics will be replaced with 9 or 10 traits in the pending IAEA Guideline.	