NATIONAL NUCLEAR REGULATOR

For the protection of persons, property and the environment against nuclear damage

POSITION PAPER

Conformity Assessment of Pressure Equipment in Nuclear Service

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professionalism integrity valuing our people excellence teamwork

UNRESTRICTED

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1 INTRODUCTION

The fundamental safety objective of the National Nuclear Regulator (NNR) Act is to protect persons, property and the environment from the harmful effects of ionizing radiation. This is primarily accomplished for nuclear installations by preventing nuclear accidents with a high level of confidence through conservative design, reliable operation and high level of integrity of the pressure equipment. The requirements of sound and conservative design, high quality in manufacturing, construction and operation, and quality management that assures manufacture in accordance with the design intent is therefore a key and fundamental part of safe nuclear operation.

The NNR is mandated to exercise regulatory control related to safety of nuclear installations and provides authorisation through a nuclear installation licence (NIL). The authorisation process requires that a safety assessment needs to be developed by the applicant that will demonstrate the safety of the nuclear installation. Taking into consideration the relevant regulatory standards, requirements and criteria, the NNR assesses the quality of the design and the functionality of the quality management systems, by conducting independent analyses and by assessing compliance with design-related quality management principles.

The Pressure Equipment Regulations (PER) [4] as promulgated under the Occupational Health and Safety Act of 1993 [3] provides the essential mandatory safety requirements with respect to the use of pressure equipment (as defined). The legal obligations and responsibilities of manufacturers and owners in respect of design, manufacturer, registration, operation, inspection and maintenance are contained in the document. The PER further requires the application of an applicable health and safety standard and of SANS 347 [6] in terms of categorisation and conformity assessment of pressure equipment. Regulation 735 of 2009 [5] incorporates SANS 347 [6] and SANS 10227 [7] as applicable standards into the Pressure Equipment Regulations [4].

SANS 347 [6] categorises pressure equipment into hazard categories based on the fluid characteristics and energy content as computed by the product of the design pressure and nominal diameter for piping or volume for steam generators and vessels. These hazard categories form the basis for the selection of different levels of conformity assessment requirements. The hazard to the public and workers is considered to be the direct consequences of explosion and corrosive or toxic substance release. SANS 347 [6] does not however in its hazard assessment consider the particular risks and consequences posed by substances that may cause ionizing radiation as is possible from the failure of pressure equipment in nuclear service. Hence, in the view of the NNR, conformity assessment requirements are not adequately defined for pressure equipment in this category of service.

Conformity assessment plays a critical role in ensuring that the appropriate and required level of quality is implemented in the design, manufacture, installation and use of pressure equipment. In order to promote consistency in the National Regulatory Framework, the NNR recommends that amendments will need to be made to include considerations for the risk of ionizing radiation as an additional hazard category determinant for pressure equipment used in nuclear service. This document reviews ways in which this may be achieved.

2 PURPOSE

The purpose of this document is to:

i. Define the aspects that need to be taken into consideration in the development of minimum requirements for conformity assessment of pressure equipment in nuclear service in South Africa.
ii. Specify the NNR minimum requirements for conformity assessment of pressure equipment in nuclear service.
iii. Provide an NNR view as to how the National Regulatory Framework may be adapted to include regulations and standards for conformity assessment of pressure equipment in nuclear service.

3 SCOPE

The document addresses the requirements for conformity assessment for pressurised equipment used in nuclear installations where malfunction of such equipment may directly or indirectly lead to a release of ionising radiation.

The document applies to:

- existing holders of a nuclear installation licence (NIL) for inspection and test activities of pressure equipment (components and systems) as required by Section 11 or alternatively Section 12 of Regulation 734 [4],
- existing holders of a nuclear installation licence (NIL) for repair and modifications activities of pressure equipment (components and systems) as required by Section 13 of Regulation 734 [4],
- applicants for a nuclear installation licence (NIL) for a new nuclear installation.

The following equipment are excluded:

- transportable pressure equipment;
- pressure equipment only needed in the construction of a nuclear facility or serving only maintenance duties carried out by personnel;
- reactor pressure vessel internals;
- containments and containment liners.

4 TERMS, DEFINITIONS, ACRONYMS AND NOTATIONS

4.1 Terms & Definitions

In this document any word or expression to which a definition has been assigned in the NNRA [1], SSRP [2], OHSA [3] or PER [4] shall have the same meaning.

Term, Definition	Explanation
Authorised Inspection Agency / Approved Inspection Authority	An organisation that is empowered by the local authority or regulatory body to provide inspection personnel and services as required by the regulations, standards or codes.
Certification	The act of determining, verifying, and attesting in writing to the qualifications of personnel, processes, procedures, or items in accordance with specified requirements
Conformity Assessment	Conformity assessment is any activity to determine, directly or indirectly, that a process, component, or service meets relevant standards and fulfils relevant requirements.
Important to nuclear safety	Provide or support safety functions to ensure nuclear safety in terms of the Fundamental Safety Functions. Products important to nuclear safety are safety classified in accordance with RD-0034.
Inspection	Examination, measurement, testing or gauging to verify whether an item or activity conforms to specified requirements
Integrated Management System	A single coherent management system in which all the organisational processes are integrated to enable the organisation's goals, strategies, plans and objectives to be achieved.
Product	A product is the result of a material or non-material process and includes components and services.
Quality Plan	document specifying which qualified procedures and associated resources will be applied by whom and when to a specific project, component, process or contract
Resources	'Resources' includes personnel, infrastructure, the working environment, information and knowledge, and suppliers, as well as material and financial resources.
Safety Classification System	A grading system that classifies SSC commensurate with their importance to nuclear safety.
Safety Culture	Characteristics and attitudes of organisations and individuals which ensure that, as an overriding priority, nuclear safety issues receive the attention warranted by their significance.

Term, Definition	Explanation
Safety Functions	Specific SSC functions that must be accomplished for nuclear safety at SSC level to support the achievement of a Fundamental Safety Function
Structure	Structures are the passive elements: buildings, vessels, shielding, etc
System	A system comprises several *components*, assembled in such a way as to perform a specific function
Testing	An element of verification for the determination of the capability of an item or SSC to meet specified requirements by subjecting the item / SSC to a set of physical, chemical, environmental, accidental or operating conditions

4.2 Acronyms and notations

Abbreviation	
AIA (SANS 347 context)	Approved Inspection Authority
AIA (ASME context)	Authorized Inspection Agency
ASME	American Society of Mechanical Engineers
DoL	Department of Labour
NIL	Nuclear Installation Licence
NNR	National Nuclear Regulator
NNRA	National Nuclear Regulator Act
OHSA	Occupational Health and Safety Act
PER	Pressure Equipment Regulation
PE	Pressure Equipment
QA	Quality Assurance
RCC-M	Design and construction Rules for Mechanical Components of PWR Nuclear Islands – published by AFCEN
SANAS	South African National Accreditation System
SANS	South African National Standards
SSRP	Regulations in terms of section 36, read with section 47 of the NNR Act no. 47 of 1999 on Safety Standards and Regulatory Practises
SSC	Structures, Systems and Components

5 CURRENT SOUTH AFRICAN REGULATORY FRAMEWORK AND DEFINED RESPONSIBILITIES

5.1 Occupational Health and Safety Act (Act No. 85 of 1993)

The Occupational Health and Safety Act (OHSA) [3] provides requirements for inter alia the protection of the health and safety of persons in connection with the use of plant and machinery against hazards to health and safety arising out of or in connection with the activities of persons at work.

Section 43 of the Act requires the Minister to make regulations including regulations as to the planning, layout, construction, use, alteration, repair, maintenance or demolition of buildings and the design, manufacture, construction, installation, operation, use, handling, alteration, repair, maintenance or conveyance of plant and machinery. This section also provides for the preventive and protective measures for major hazard installations with a view to the protection of employees and the public against the risk of major incidents.

Section 44 of the Act allows for the incorporation of health and safety standards in regulations. This section specifies the design codes and standards that may be used for components that may be used in electrical, mechanical or pressurized systems.

The Department of Labour (DoL) has the responsibility to regulate occupational safety under the Act. DoL also regulate pressurised systems and equipment both in nuclear and other conventional applications through the registration of boilers and pressure vessels, approval and regulation of approved inspection authorities, and enforcement of the regulations.

5.2 National Nuclear Regulator Act

The National Nuclear Regulator Act (NNRA) [1] provides for the regulation of nuclear activities. The NNRA confers upon the NNR the responsibility of inter alia providing technical and administrative requirements for nuclear authorisations that includes the exercising of regulatory control related to safety over the design, construction, operation and manufacture of component parts of nuclear installations.

The NNR requirements specify the submission of a safety assessment (often referred to as a safety case) in support of an application for a nuclear authorisation. The safety assessment must as one requirement, demonstrate the adequacy of the plant design and operational procedures through formalised safety analyses. One aspect of the demonstration of safety adequacy that is assessed by the NNR is the appropriate use of codes and standards in the design, manufacture, construction, operation, inspection, modification and repair of structures, systems and components. In principle, any design, construction and inspection code or standard that is internationally accepted for application at nuclear facilities can be proposed for design and construction. However, the codes and standards must be justified in terms of the application and must be applied consistently, without omission of conditions or embedded requirements.

While the NNR does not authorize or regulate the use of specific equipment or components, the NNR performs compliance assurance related monitoring activities verifying assumptions and specifications resulting from the safety argument. This includes performing detailed assessments of plant component and system design for structural adequacy and construction quality during the review of safety assessments.

There is therefore an overlap between the roles of the NNR and the DOL as regards to regulatory oversight of a nuclear installation's design, construction, commissioning and operation in particular as it relates to pressurized systems and pressure equipment.

5.2.1 Pressure Equipment Regulations (R.734 and R.735 of 2009)

The PER [4] provide mandatory requirements for the design, manufacture, operation, repair, modification, maintenance and testing of pressure equipment where the design pressure of the equipment is equal to or greater than 50kPa. While there are a number of exclusions from the scope of application, there is no specific exclusion for pressure equipment in nuclear service.

The PER specifies the duties of manufacturers, importers and suppliers, users and AIA and invokes the application of the following standards relevant to pressure equipment to be used in South Africa;

- SANS 347 [6] in terms of categorisation and conformity assessment of pressure equipment,
- SANS 10227 [7] in terms of the criteria for the operation of inspection authorities performing inspection in terms of the PER.

  The PER requires that the manufacture, modification, inspection, testing or repair is performed subject to the requirements of an applicable health and safety standard. A list of approved health and safety standards is included in SANS 347.

5.2.2 SANS 347: Categorisation and Conformity Assessment Criteria for Pressure Equipment

SANS 347 [6] is an incorporated standard in the schedule of the PER [4] and specifies the criteria to be used for the categorization and conformity assessment of pressure equipment (metallic and non-metallic materials). Pressure equipment are categorised into hazard categories based on the fluid characteristics and the product of the design pressure and nominal diameter for piping or volume for steam generators and vessels. A number of conformity assessment modules are defined, that provide a minimum set of requirements or procedures that the manufacturer or the manufacturers authorised representative uses to confirm compliance with the applicable statutory regulations. The module choice is proportionate to the conventional risk posed by the pressure equipment as categorised by the hazard category. The approved Inspection Authority is tasked with separate conformity assessment responsibilities in order to verify the conformity of the pressure equipment with the requirements.

The categorisation and conformity assessment criteria of SANS 347 is based on the European Directive 97/23/EC also known as the Pressure Equipment Directive (PED). Article 1, Paragraph 3.8 of the PED provides the following exclusion from the scope of the Directive:

- items specifically designed for nuclear use, failure of which may cause an emission of radioactivity.

SANS 347 does not have a similar exclusion. While this explicitly means that all pressure equipment for nuclear use falls within the scope of its requirements, SANS 347 does not however in its current form consider the particular risks and consequences of the possible release of ionizing radiation as is possible from the failure of pressure equipment in nuclear service. As a result of this risk, health and safety standards for nuclear equipment in general provide more conservative design manufacturing and conformity assessment criteria.

It is therefore important that the conformity assessment requirements in SANS 347 provide equivalent levels of requirements for the various classes of nuclear pressure equipment.

5.2.3 SANS 10227: Standard Specification for the criteria for the operation of inspection authorities performing inspection in terms of the Pressure Equipment Regulations

Both the PER and SANS 347 require the intervention of an Approved Inspection Authority in the assessment of adequacy of pressure equipment both during manufacturing and operation of the equipment.

The criteria for bodies performing inspection in terms of the PER are contained in SANS 17020 [8] and SANS 10227 [7]. These criteria include the applicable administrative requirements, requirements on independence, impartiality, integrity, quality systems and confidentiality. SANS 17020 is the International (ISO) standard that has been adopted for use as the base document for the accreditation of Inspection Bodies in South Africa. It is supplemented by SANS 10227 that provides the specific accreditation criteria to meet the South African Regulatory requirements that include the approval process (of inspection authorities), the scope of activity, and the qualification requirements of personnel.

6 BASIS FOR THE ENHANCEMENT OF CURRENT CONFORMITY ASSESSMENT REQUIREMENTS IN SANS 347 BY NUCLEAR RISK CONSIDERATIONS

6.1 Current Regulatory Oversight Practices

The PER provides the regulations for the design, construction and use of pressure equipment in industry. As it is the role of the South African Government Department of Labour to regulate Occupational Safety under the OH&SA, it is also their role to regulate pressure equipment both in nuclear and other conventional applications through the registration of boilers and pressure vessels, approval and regulation of approved inspection authorities and enforcement of the regulations. The PER does not provide specific design criteria, but rather incorporates a list of approved health and safety standards or codes that are required to be used for the design and construction of approved vessels under pressure. The PER places the responsibility of conformity assessment on the manufacturer (or importer) of the pressure equipment. The manufacturer is responsible for construction of the pressure equipment with the view to providing it to the market.

The NNR regulates nuclear activities in accordance with the NNRA [1]. This act confers upon the NNR the responsibility of inter alia providing technical and administrative requirements for nuclear authorisations that includes the exercising of regulatory control related to safety over the design, construction, operation and manufacture of component parts of nuclear installations.

The NNR licensing requirements specify the submission of a safety assessment in support of an application for a nuclear authorisation. The safety assessment must as one requirement, demonstrate the adequacy of the plant design and construction through formalised safety analyses. One aspect of the demonstration of safety adequacy that is assessed by the NNR is the appropriate use of codes and standards in the design, manufacture, construction, operation, inspection, modification and repair of structures, systems and components as well as the demonstration of the implementation of the appropriate quality and safety requirements. In contrast to the PER, the NNR Act however places the responsibility of all aspects of the nuclear installation including design and manufacturing on the owner of the nuclear installation. The NNR performs assurance compliance related monitoring activities that includes performing detailed structural adequacy assessments of plant component and in certain cases also perform independent conformity assessment activities on manufacturers and suppliers to the nuclear industry.

Similar to the philosophy of the PER, the NNR requirements require that the level of oversight applied to pressure equipment in the design and manufacturing process must be commensurate with the level of risk posed by failure of the equipment. In the nuclear environment however, while the conventional risks are important, the dominant risk to be evaluated is that of release of ionizing radiation as a result of equipment failure. The NNR have therefore communicated to the DoL and SANAS its requirement that any pressure equipment intended to be used in nuclear industry shall conform to the highest level of conformity assessment requirements for the conventional pressure equipment as given in SANS 347 along with additional NNR requirements. These requirements (P-0694-C) are currently used as a basis for SANAS accreditation of Approved Inspection Authorities (AIA) for pressure equipment in nuclear service.

Note: P-0694-C dated 21 November 2006 needs to be revised and updated to reflect the current regulations and standards applicable i.e. PER Regulation 734, ASME QAI-1:2010,SANS 10227, SANS 347 etc.

While the two regulatory approaches are not contradictory, from experience, the dual level of regulation has:

- tended to lead to duplicative efforts in certain areas between the Regulators,
- tended to be confusing to the industry in terms of the actual requirements to be met by the owners, manufacturers and AIA.
- not been clear in terms of requirements for competence demonstration for both manufacturers and AIA.

To promote consistency in the South African Regulatory Framework as it relates to pressure equipment in nuclear service, amendments will need to be made to SANS 347 to include considerations for PE used in nuclear service in order to ensure consistency with national requirements. An alternative is that a similar exclusion to the one in the PED needs to be included into SANS 347. This would allow a “sister” document to be drafted specifically for equipment in nuclear service. SANS 10227 and SANS 17020 may also have to be amended.

Note: ISO/SANS 17020 is an international standard, currently in review and is due for publication later in 2012. As this is an ISO standard any suggested changes must be done formally through the local ISO member body, the SABS. SANS 10227 is a national standard currently in review.

6.2 Application of Design Codes and Standards for Nuclear Use in South Africa

The NNR requires that the safety adequacy of the nuclear installation is demonstrated. One of the requirements in this demonstration is the appropriate use of codes and standards in the design, manufacture, construction, operation, inspection, modification and repair of structures, systems and components.

The NNR does not specify the use of any specific design code or standard. There are also no specific design codes and standards that have been developed in the RSA for safety important products used in the South African nuclear industry. In principle, any design, construction and inspection code or standard that is internationally accepted for application at nuclear facilities and that is contained on the list of approved health and safety standards included into SANS 347 may be proposed for design and construction. The PER through SANS 347 incorporates a list of approved health and safety standards or codes. Two nuclear codes are currently listed for PE in nuclear service. These are the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III and the French RCC-M code.

The NNR requires that, the codes and standards must be justified in terms of the application and must be applied consistently, without omission of conditions or embedded requirements. However, should the consequences of failures have the potential to challenge the licensing criteria, additional administrative (such as multi-party inspections) and technical (such as additional non-destructive and destructive testing) provisions against such failures may have to be provided, or deterministic evidence given that such failure assumptions can be excluded from design considerations.

Where new or modified codes and standards are developed, they must be justified and proposed for approval by the relevant authority.

6.2.1 Oversight Requirements from the ASME BPV Code

The United States Nuclear Regulatory Commission (NRC) regulates the US commercial nuclear industry in accordance with the US Code of Federal Regulations (CFR). Section 55a of 10 CFR Part 50 requires that systems and components for nuclear power plants under construction and in operation meet the requirements of the ASME Codes incorporated by reference in the regulation as applicable.

The ASME Boiler and Pressure Vessel Code, Section III provides requirements for the construction of nuclear power plant items, such as vessels, storage tanks, piping, pumps, valves, core support structures, and component supports, for use in, or containment of, portions of the nuclear power system or containment system of nuclear power plants. Section III provides requirements based on the classification of plant components from their application in the nuclear power plant and is intended to cover new construction and includes consideration of mechanical and thermal stress due to cyclic operation.

The ASME rules for conformity assessment are fully integrated into the code. The basic rules for quality assurance and authorized inspection of nuclear equipment are contained in the ASME construction code Section III, Division I Articles NCA-4000 and NCA-5000 respectively.

ASME Section III, Article NCA-4000 provides requirements for planning, managing and conducting quality assurance programs for controlling the quality of activities performed by Certificate Holders in accordance with the ASME Section III code. The Article mandates the implementation of ASME NQA-1 Quality Assurance Requirements for Nuclear Facility Applications that provides detailed requirements for the establishment and execution of QA programs during siting, design, construction, operation and decommissioning of nuclear facilities. The rules apply to, among other items, design control, procurement document control, control of purchased items, identification and control of items, control of processes, inspection, test control, control of nonconforming items, corrective action, and quality assurance records.

ASME Section III Div 1 Article NCA-5000 provides the inspection requirements for the items constructed (ASME Section XI Article IWA-2000 for Inservice Inspection) by the Authorized Inspection Agency. The Authorized Inspection Agency is required to be accredited by the ASME Society in accordance with the provisions contained in ASME QAI-1, Qualification for Authorized Inspection. The Authorized Inspection Agency is a 3rd party inspection body, meaning that while it is contracted by the Certificate Holder (manufacturer) it is not affiliated to the manufacturer and performs its service completely independently. The AIA is also not affiliated to the Regulator. The ASME system credits the AIA oversight function which is accepted by the Regulator.

The United States Nuclear Regulatory Commission (NRC) Regulatory Guide 1.28, Revision 4, Quality Assurance Program Requirements (Design and Construction), provides conditional acceptance of ASME NQA-1-2008 and NQA-1a-2009 Addenda, “Quality Assurance Program Requirements for Nuclear Plants in that they provide an adequate basis for complying with the pertinent quality assurance requirements of the US legal requirements contained in Appendix B to 10 CFR Part 50. Hence in the USA the ASME code is fully integrated into the legal requirements.

In South Africa the Koeberg Nuclear Power Station comprising 2 pressurised water reactor units was built by a French consortium in the mid 1970’s. The design followed the ASME Section III code, 1971 edition for the pressure equipment of the nuclear steam supply system. The quality assurance practices however followed French practice at the time. It is recognized however that for any new nuclear reactor construction projects as contemplated by the South African Nuclear Energy policy, that an effort has to be made to ensure consistency between the technical and the programmatic requirements in the design, fabrication and operation of nuclear pressure equipment.

The ASME code uses a system of certification to accredit conformance to the ASME code requirements. As a condition of obtaining and maintaining ASME Certificates of Authorization the Manufacturer must have in force an inspection contract or agreement with an accredited Authorization Inspection Agency (AIA) at all times. The AIA performs all required inspections at the location identified in the Certificate of Authorization and for the type of work listed in the scope of the ASME Certificate of Authorization.

Equipment or components constructed in accordance with all of the applicable rules of the ASME code including requirements for materials, design, fabrication, examination, inspection, and stamping may be identified with the official Code Symbol Stamp described in the governing section of the Code. The code stamp provides a high level of confidence in the integrity and capability of the final product both to user and regulator. In fact endorsement is given in Paragraph 7.(4) of the PER that in effect states that imported pressure equipment bearing the ASME code stamp meets the requirements of the PER.

The direct application of the ASME code by designers and manufacturers outside of the United States and Canada does however have its barriers. In many areas of the code where qualification and experience requirements are listed for various activities, the

ASME requirement stipulates fulfilment of certain geographical criteria as the following table illustrates.

Document	Paragraph	Role	Specific ASME Requirement
ASME III Div 1. Mandatory Appendix. Article XXIII-1220	Article XXIII-1220 Registration And Experience	Personnel engaged in design certification activities	He shall be a Registered Professional Engineer in at least one state of the United States or Province of Canada.
ASME QAI-1 2005 2010?	Paragraph 1-1.1 Qualifications – (Authorized Inspection Agency) For Section III Div 1 and Div 3.	The Authorized Inspection Agency provides the authorized inspection service using inspectors who meet the qualifications of the Authorized Nuclear Inspector	An Authorized Inspection Agency is one designated by, or acceptable to, the appropriate legal authority of a state of the United States of America, or province of Canada, that has adopted Section III, Division 1 or Section III, Division 3, of the ASME Boiler and Pressure Vessel Code.
ASME QAI-1 2005 2010?	Paragraph 1-2.1 Qualifications – (Authorized Nuclear Inspector Supervisor) For Section III Div 1 and Div 3.	Duties as per ASME QAI-1 sections 1-2.2.1 through 1-2.2.10.	To be considered for certification a candidate shall satisfy one of the following requirements: *(a)* graduate of a 4-year accredited engineering or science college or university, plus 5 years of experience in quality assurance, including testing or inspection (or both) of equivalent manufacturing, construction, or installation activities.
ASME QAI-1 2005 2010?	Paragraph 1-3.1 Qualifications – (Authorized Nuclear Inspector) For Section III Div 1 and Div 3.	Duties as per ASME QAI-1 sections 1-3.2.1 through 1-3.2.18.	All Inspectors shall comply with the National Board Rules for Commissioned Inspectors, and hold a valid State Certificate of Competency (where required) and a valid National Board Commission. An applicant for designation as an Authorized Nuclear Inspector shall satisfy the requirements as defined by 1-3.1.1 through 1-3.1.8 of QAI-1. In order to be issued a commission, the candidate must be employed as inspector by a jurisdiction, an Authorized Inspection Agency, Owner-User Inspection Organization, or a

			Federal Inspection Agency.

Notes:

The ASME Code requires the use of Registered Professional Engineers (RPE) to certify Design Specifications, Construction Specifications, Design Drawings and the Design (Stress) Report. Compliance with the ASME Code is a regulatory requirement. The requirement for RPE certification is only applicable to systems and components that are required to meet the ASME Code; i.e., pressure boundary components.

The table above lists the ASME sections relevant to design and construction only. There are separate qualifications and requirements for Section III (Design and construction) and Section XI (Inservice Inspection) Agencies.

It is possible for organisations outside of the USA and Canada to receive holding authorized inspection agency certificates of accreditation (eg Lloyds Insurance). The benefit for the South African industry in terms of full certification should be weighed against the total effort spent in maintaining such accreditation bodies locally. Given the Koeberg experience, the use of bodies accredited through some local system of similar rigour may be adequate for the needs of the local nuclear industry.

Section 6.2.1 describes the ASME system and needs to be revised to include the equivalent local South African system as covered by the PER and 10227

6.2.2 Oversight Requirements from the RCC-M Code

The RCC-M [15] code was developed from the ASME Section III code and French construction practices by AFCEN, an association that was founded by Electicité de France (EdF) the operator of the French nuclear power plant fleet and Framatome the French nuclear design and construction company. The current day RCC-M code is a fully developed internationally recognised code that focuses specifically on pressurised water reactor (PWR) components.

Unlike the ASME code where the certificate holder and code stamp process provides the assurance in the integrity and capability of the final product, in RCCM the code stamp and certificate holder process is not employed.

The RCCM code places the responsibility on the contractor manufacturer or supplier to implement a quality system that is compliant with the code. The ISO 9001 code and the IAEA 50-C/SG-Q are required that provides the basic requirements to be adopted for establishing and implementing quality assurance programmes.

Conformity assessment of nuclear pressure equipment in France is carried out under Sections 11 and 12 of the Decree of 12 December 2005 [14], commonly called the ESPN Order. It includes those components that are considered as nuclear-specific and that directly ensures containment of radioactive substances that by its failure would lead to an activity release above 370 GBq.

The Order classifies these components in three categories, N1 to N3 depending on the quantity of radioactive emissions that could result from the failure of the equipment. The equipment is then classified into five further categories depending on the contained energy level (pressure, temperature and volume) and type of fluid. A conformity assessment matrix is then applied similar to the method of conformance evaluation applied by the PED for conventional pressure equipment.

The main difference is that for all equipment classified N1; the French nuclear Regulator (ASN) assumes the direct responsibility of the approved inspection authority as contemplated in SANS 347. The ASN both assesses the RCC-M code design as the French Regulator has not formally approved the code, as well as performs the conformity assessment. The PED approach is adopted for equipment classified level N2 and N3.

6.2.3 NNR Requirements on Quality and Safety Management

Regulation 388 [2] on safety standards and regulatory practices requires the establishment, implementation and maintenance of a quality management programme. This requirement is expanded in NNR document RD-0034 [9] on quality and safety management requirements for nuclear installations. The document applies equally to applicants/holders of a nuclear installation licence in South Africa and service organisations involved in the design, manufacturing, construction, commissioning, operation, modification and potential decommissioning of such nuclear installation.

RD-0034 must be referred to for detailed requirements and it is not the intention to duplicate or analyse the document content here.

RD-0034 requires that the management system has to be appropriate to the safety importance of the product(s) provided by the organisation. Hence it sets the implementation of a safety and quality classification system under which all services and products have to be classified as a requisite. The safety and quality classification system is required to take into consideration the possible nuclear consequences of the failure of the service or the product in service. The safety and quality classification system is required to have at least 3 levels briefly summarised below;

Level 3 - all products of the nuclear installation not classified as level 2 or level 1
An appropriate QMS as determined by the licensee is mandatory as a basis for all service organisations and must include QA measures specified for the particular products of the organisation.

Level 2 (products important to nuclear safety)
At minimum the implementation of the ISO 9000 series standards or equivalent QMS is required in addition to QM processes, design codes and standards that are specific to nuclear installations.

Level 1 - (Direct Influence on the safety performance of the nuclear Installation)

In addition to the QMS system as required for Level 2, a safety management system must be part of an integrated management system that includes the consideration of safety culture aspects.

In terms of conformity assessment requirements for pressure equipment therefore, the NNR requirement is that all manufacturers of pressure equipment must have a quality management system in place. Therefore in terms of current SANS 347 requirements (Edition 1), for hazard categories II or III, manufacturers have a choice of modules H1 or B+E, and for hazard category IV manufacturers have a choice of modules H1 or B+E2 for equipment in nuclear service. These modules may neither be optimal nor correct when considering the RD-0034 requirements.

7 ATMOSPHERIC STORAGE TANKS

The PER excludes atmospheric storage tanks from its scope. There is however value in including this category of equipment where used in nuclear installations into the considerations and conclusions of this document due to the similarity of design conditions, manufacturing processes and oversight requirements.

8 NNR POSITION ON CONFORMITY ASSESSMENT

The NNR position on conformity assessment relates to pressure equipment that will be installed in or are already installed in South African Nuclear Installations but may also be applicable to other RD-0034 Level 1 products depending on the reliability requirements for such products.

a) The NNR does not regulate pressure equipment manufactured for foreign use. However, if requested for information by Regulators of foreign countries in relation to pressure equipment manufactured in South Africa, the NNR will endeavor to assist as requested within the confines of South African legislation. In the case of pressure equipment manufactured outside the borders of South Africa, the ASME or RCC-M requirements will need to be met. Additionally the NNR may set further requirements (refer to PP-0012) [11].

b) The NNR requires the appropriate use of codes and standards in the design, manufacture, construction, operation, inspection, modification and repair of structures, systems and components. Any design, construction and inspection code or standard that is internationally accepted for application at nuclear facilities and meets with local authority approval can be proposed for design and construction. In principle, the codes and standards must be justified in terms of the application and must be applied consistently, without omission of conditions or embedded requirements.

c) The merging of different aspects of various codes into one application is not acceptable.

d) Acceptance of a particular code or code edition by the NNR does not infer that the NNR will not or may not add technical or administrative requirements in line with best world practice that it deems necessary and expedient and in the interest of protection of persons and environment. This is a well established principle in regulatory practice and needs no further debate. Additional requirements may amongst others relate to the design, materials, manufacturing, non-destructive and destructive examination depending on the hazard associated with the facility.

e) It is recognised that codes have requirements that not only have technical bases, but that may be related to regulatory or other approaches from the country of origin of the code. In this regard valuable work is being conducted by code organisations under the framework of the Multinational Design Evaluation Programme where code comparisons [17] are being performed between the ASME, RCC-M, Kepic (Korean), JSME (Japanese) and CSA (Canadian) codes and standards for nuclear power plant Class 1 components. This work is being followed with interest.

f) RD-0034 requires that where deviations from the code or prescribed condition for application of the code are required, this must be justified and presented to the NNR for concurrence. An example of such deviation might be the use of a South African Approved Inspection Authority in the role of the ASME contemplated Authorized Inspection Agency. The NNR requirements as discussed in NNR correspondence to SANAS, P-0694-C [10], accepts this approach on the condition that the duties and level of competency of the organisation and individuals are at least equivalent to that intended by the ASME III code and applicable standards (NQA-1, QAI-1, etc). The direct implication from a nuclear regulator point of view is that while the achievement of the ASME code stamp is not a prerequisite, the fulfilment of the technical, quality and the intent of the administrative requirements of the ASME code is necessary for the manufacture and use of ASME pressure equipment for nuclear use in South Africa.

g) The implication of not having a local code and of following a non-prescriptive approach to codes and standards usage means that inevitably some duplication of capability will need to be carried by organisations serving the industry in South Africa. Should the licensee or license applicant adopt the use of either ASME or RCC-M, the regulatory infrastructure (NNR, DoL, SANAS, and AIA) must develop the capability to respond appropriately with suitable knowledge and experience. This means that the capability to service conformity assessment requirements for both ASME (Section III) and RCCM is required. From a design verification point of view it is clear that equal competencies in both design codes are required. From a conformity assessment point of view, a basic model has already been established for the ASME code as discussed above.

h) The NNR view is that a nuclear equivalent of SANS 347 would need to be compiled. The document needs to define the scope of applicability based on the risk posed by pressure equipment in nuclear use. This definition may be based on either the RD-0034 definitions or the French ESPN model.

i) The document would need to provide for the minimum requirements according to both the alternative ASME and RCC-M conformity assessment approaches. In terms of the ASME approach this work has already been completed and is summarised in P-0694-C [10]. In respect of the RCC-M code the approach would be to review the French regulator guidance [16] and compare the requirements with existing SANS 347, 10227, 17020. Once the gaps or differences are identified, "SANS 347 nuclear" can be authored, taking into consideration RD-0034 requirements.

j) The document must equally address the conformity assessment requirements for both new manufactured pressure equipment as well as in service pressure equipment.

k) A comprehensive review on the resources required in the Regulatory organisations and AIA in order to service the industry requirements and have oversight of the regulations must be done in order to ensure that there is minimal duplication of tasks, and that the responsible organisations develop and maintain the capability to perform the assigned services.

l) Further development may result in the merging of the two sets of conformity assessment requirements such that the new requirements envelopes the requirements of the two codes.

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